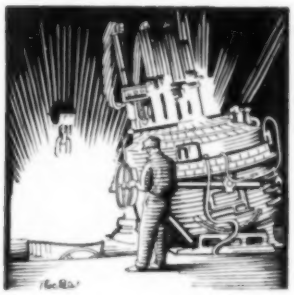
THE FOUNDRY

Established in 1892 by John A. Penton



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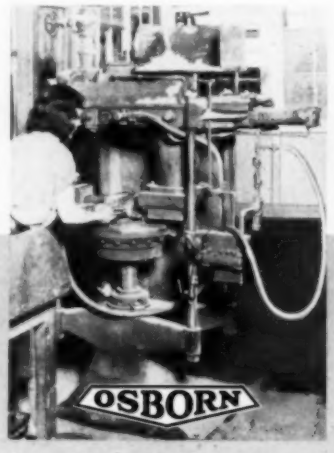

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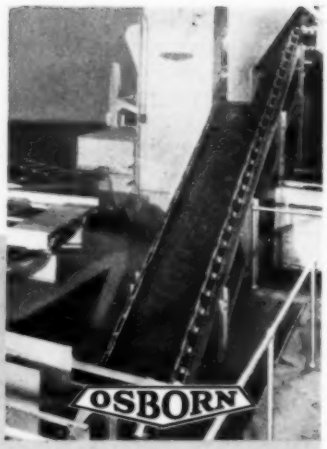

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Constantly improving design of Osborn equipment

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The Foundry Industry must be ready to meet the new demands of other industries dependent upon it. But how can it be accomplished? That is what Osborn sales engineers are prepared to discuss with you.

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THE FOUNDRY for September

A Changing WORLD

RETURNING travelers, business men who have been abroad since early summer express amazement at the transformation in American affairs during their absence. However, visible evidences and the published news tell only a portion of the story. Doing business under the NRA, operating a foundry in a codified world of business will prove amazing and perplexing even to those who have moved in the center of all the activity that has arisen since June. Those who have toiled and perspired in hotel committee rooms, who have paced the marble floors of government buildings or have participated in the heat and turmoil of Washington hotel meeting rooms may perhaps imagine that they have the complete picture. But, when they take up again the interrupted thread of their own immediate businesses, the effect comes home. Working under codes may circumscribe only a few of the major foundry wage and operating practices, but when all suppliers and customers of foundries also bring to bear certain code provisions, the entire business of castings manufacture in this day of 1933 represents new problems. These will be set forth fully in THE FOUNDRY as they develop.

When NOT A CODE

WHEN is a code not a code? *Answer*—At any point in the preliminary stages of discussion, prior to its acceptance by the NRA and the setting of a hearing date. This fact naturally escapes newspapers with their superficial and often prejudiced view of industry. It also in some instances seems to have been overlooked by publishers of business and technical papers that do not recognize a definite responsibility to individual branches of industry. Premature publication of tentative codes has been a decided dis-service to some of the foundry divisions. Such publication of suggested codes still in the stage of discussion, revision and amendment, has raised questions between foundry firms that better could have been settled within committee or general meetings. Similarly, rival interests outside the foundry industry have predicated obstructive measures upon items in these embryo codes that probably never will reach the office of the Administrator. Finally, customer representation has seized upon certain statements in these unfinished codes to file protests in advance of any consideration of background or supporting data available at proper time for consideration by the Administrator. Customer interests have full recognition in all foundry codes, as will be demonstrated. THE FOUNDRY does not recognize a code as public information, until preliminary analysis by the NRA and conference by the representatives of the government and the industry have found such document to be acceptable and a hearing date set. The first to reach this stage, presented by the Steel Founders' Society of America will be found on page 13 of this issue. Those of the malleable, gray iron and nonferrous associations also have been filed, but still are undergoing discussion and revision and are subject to amendment prior to setting the dates for hearing. All of these, with the results of public hearings and the final approval will be given in full as soon as they may be avaiable for publication to the constructive benefit of the industry.

What's New in SEPTEMBER

ADDITION of an electric furnace foundry for the production of gray iron permits a Wisconsin foundry to specialize in all types of ferrous castings (page 10). Code of fair competition of the steel castings industry nears approval at Washington, (page 13), and other foundry codes move forward (page 15). A study of the effect of phosphorus on cast iron develops interesting information (page 16), and progress is being made in casting beryllium-copper alloys (page 20). Bill discusses certain factors which he feels certain should appear in the code of an industry (page 48).

Fig. 1-A—5-ton direct arc electric furnace melts iron in the gray iron foundry. Necessary transformers and control equipment are located in rear of the furnace

Casts All Types of Ferrous Metals

Wisconsin company specializes in steel, malleable iron and gray iron castings

By FRANK G. STEINEBACH

AFTER four years of depression, with industrial activity gradually working to the lowest level in the history of our country, business again is on the upgrade, and at the same time future prospects for further betterment appear exceptionally bright. A study of business trends for the past few months shows remarkable improvement in many directions, especially in those producing groups which manufacture commodities that go to satisfy the pent up needs and desires of millions, who have held off buying during the difficult period just past, through fear of future difficulties or possible lack of funds with which to make purchases.

The basic character of castings never was better demonstrated than during this period of business improvement, for statistics show that foundry operations have been highly sensitive to consumer demands. Strength in castings demand became apparent just about as soon as improvement in other lines was discerned, and has continued to develop in an exceedingly grat-

ifying manner in many lines of activity. The universal application of castings to practically every activity of modern civilization, and the constantly increasing list of new uses of cast products, provide a front rank position for foundries in the country's industrial picture.

While orders for castings during the period of recession reached a point so low as to hardly have been considered possible during the prosperous years of the twenties, lack of business did not necessarily indicate idleness on the part of the management and certain divisions of the plant personnel. Many organizations recognized in the period an opportunity to strengthen their positions for the competitive period of prosperous business which their managements had the courage to believe would most certainly follow. One such company was the Belle City Malleable Iron Co., Racine, Wis., producer of malleable, steel and recently high test gray iron castings.

Operate Modern Malleable Foundry

Early in 1930 that company was operating a new and completely modern malleable iron foundry, with powdered coal furnaces, continuous kiln type annealing furnaces, and equipment and means to control completely each operation in the production of certified malleable iron castings. The plant had a capacity of 20,000 tons of malleable castings annually. The company also operated the Racine Steel Castings Co., a foundry located just across the street from the malleable shop, and employing electric furnaces as the melting medium. It is interesting to note that the company was one of the pioneers in the use of the electric furnace in the melting of steel, the first unit with a capacity of 3 tons having been installed in its plant in 1916, following a number of years of experience with crucible melting.

Fig. 2—A printing press frame casting made of electric furnace gray iron

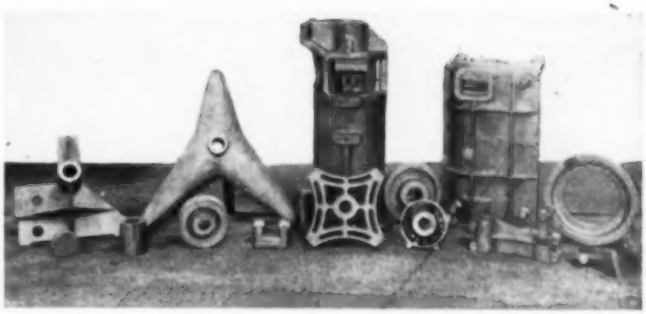


Fig. 3—A group of gray iron castings for a variety of applications, including automotive, electric refrigeration, etc.

A survey by company engineers shortly after the start of the depression, indicated that the Belle City firm possessed a capacity for malleable castings in excess of that which normally could be considered the potential demand for that type of product in the territory served by the organization. Improvements in equipment and practices which were made a short time before when the malleable shop was entirely rebuilt, had so increased the efficiency of the plant that it was decided one air furnace and a section of the plant, about 150 x 450 feet, were not needed in the malleable foundry. This manufacturing space of course would be available for other lines of activity.

With years of experience in the manufacture and sale of both malleable and steel castings, with a splendid reputation for service and the production of a high quality product, and with plant and laboratory facilities already available, it is only natural that the company would look toward further expansion in the field of castings manufacture. Believing that an important field existed for high grade gray iron castings produced in the electric furnace, and feeling that the experience of the company's operating personnel and research organization was such as to permit the production of a product suitable for certain definite needs which were known to exist, the company decided to establish a gray iron division in the section of the malleable foundry withdrawn from production. The first heat in the gray iron shop was taken off in November, 1930.

Install 5-Ton Electric Furnace

The gray iron division consists of two molding floors about 400 feet in length, one floor for machine molding and the other for floor work. A 5-ton direct arc type electric furnace was installed at one end of the gray iron department, and the necessary transformer and control equipment located immediately in the rear of

Fig. 4—An ink fountain and wall bracket casting for a printing press, made of electric furnace iron

the electric furnace. Certain advantages have been provided by locating the electric furnace in a pit. Greater headroom permits cranes to operate over the furnace and assists in all handling operations around the melting unit. One floor controlled crane is operated over the furnace to handle the charging spout and the electrodes. Two cranes of the traveling type extend from the furnace over the machine molding floor and are employed in transporting molten metal from the furnace to the molds.

Bins have been built along one side of the pit and under the floor, for coke, limestone and other materials. While scrap is handled from the yard to the furnace with a crane, a sufficient amount is held in reserve at the furnace to make necessary alterations in composition after preliminary tests have been made on the iron. The charges consist of 30 per cent of borings, 30 per cent of domestic scrap and the remainder steel scrap, flashings and sprue, varying according to the composition of the metal desired. Metal is carried to a superheat of 2850 degrees Fahr. and the pouring temperature is permitted to vary according to the castings being poured. The hottest pouring temperature is 2700 degrees Fahr. and in all instances, the metal is simply allowed to stand in the ladle until the desired temperature is reached.

Melt Down the Cold Charges

Metal for gray iron casting is melted down from the cold charge, the time of melting depending upon several factors including which one of three electric furnaces, which are available in the company's foundries, is being used. For example, a 2-hour cycle is required for melting gray iron in the 1½-ton electric furnace located in the steel foundry, and used on occasion for gray iron production. Considerable attention is paid to control of metal during melting. Test bars are cast on every heat and both preliminary and final analyses are made. The final analysis includes the determination of both physical and chemical properties of the metal.

Accurate records are kept of all information secured in the various tests. A job record includes an analysis of the castings made from every pattern, so that no difficulty will be encountered in duplicating the casting in chemical analysis at a later date. The company also records the brinell hardness of all castings shipped. As a part of the various tests, a careful study is made of the microstructure of the iron.

Ample Facility for Sand Storage

Gray iron castings are made in both dry and green sand, depending on the particular job. Backing sand is prepared with a sand cutting machine and the facing sand is worked in a muller type mixer. Ample facilities for the storage of both molding and core sand are provided at one side of the malleable and gray iron foundry building.

A study of the entire plant facilities emphasizes the complete flexibility in equipment and practice now provided by the Belle City company. For example, the fact that the company also operates a steel foundry in which two electric furnaces are employed as melting mediums results in many economies and advantages in the control of the energy charge. At times, during the past year or so, when the demand for all types of castings was extremely light, it was possible to center production of both steel and gray iron castings in the steel foundry, employing the 1½ or the 3-ton furnace or both as occasion demanded.

The same physical and chemical laboratory now serves the three divisions producing ferrous castings, and a modern sand control laboratory also is available for all sand control work. The capacity of the core room, a part of the malleable foundry, is sufficiently flexible also to provide cores for the gray iron department. In the light and well ventilated core room, the sand is handled continuously to the core making stations from the mixing (*Please turn to page* 51)

Fig. 5—Machine and pattern used for molding one of the castings illustrated in Fig. 3

Steel Founders' Society Code

Country divided into 21 wage districts for minimum pay rates for general labor

STEEL Founders' Society of America, on Aug. 23, presented a code of fair competition of the steel casting industry to the National Recovery administration at Washington. The formal hearing on this code, which has been agreed to by 80 per cent of the producing capacity of the industry, has been set for Sept. 7, 1933, the code with description of wage districts, minimum rates of pay for general labor and list of unfair trade practices is as follows:

Article I—Definitions

The terms used in this code and in any schedule attached thereto are defined as follows:

Sect. 1—The term "the United States" means and includes all of the territory subject to the jurisdiction of the United States of America.

Sect. 2—The term "the President" means the President of the United States of America.

Sect. 3—The term "the Industry" means and includes the business of producing and/or selling steel castings in the United States, except as produced and/or sold as a part of the products, including finished parts thereof, of an owning or an affiliated company, but not sold in the open market as castings in competition with similar castings produced by other members of the Industry.

Sect. 4—The term "Miscellaneous Castings" means that group of steel castings commonly known in the trade under that name and produced by foundries to the order of the buyers from the buyers' designs, patterns and specifications, such castings usually being sold in the rough.

Sect. 5—The term "Specialties" means that group of cast steel products commonly known in the trade under that name and primarily designed and engineered by the foundry companies producing them, produced from patterns and/or other production equipment belonging to the producer, and sold as finished or semi-finished devices or parts thereof.

Sect. 6—The term "member of the Industry" means and includes any person, firm, association or corporation engaged in business in the industry.

Sect. 7—The term "the Society" means Steel Founders' Society of America.

Sect. 8—The term "the Board of Directors" means the Board of Directors of the Society.

Sect. 9—The term "the National Industrial Recovery Act" means the National Industrial Recovery act as approved by the President, June 16, 1933.

Sect. 10—The term "the Administrator" means the Administrator appointed by the President under the National Industrial Recovery act and at the time in office.

Sect. 11—The term "the Administration" means the agency established pursuant to the provisions of Sect. 2 of the National Industrial Recovery Act.

Sect. 12—The term "the effective date of the Code" means the first Monday after the fourth day following the date on which this code shall have been approved by the President pursuant to the National Industrial Recovery act.

Sect. 13—A company, in its relation to another company, is defined as an "affiliated company" when either one has, directly or indirectly, a substantial interest in the other, or when a third company has, directly or indirectly a substantial stock interest in both.

Article II—Purpose

Sect. 1—This code is adopted pursuant to Title I of the National Industrial Recovery act.

Sect. 2—The purpose of this code is to effectuate the policy of Title I of the National Industrial Recovery act insofar as it is applicable to the industry.

Article III—Scope

Sect. 1—Articles I to XI inclusive of this code shall apply to the entire industry; in view, however, of the divergent producing and selling methods applying to the two main groups of castings, namely, miscellaneous castings and specialties, separate provisions are set forth covering the unfair trade practices of each group.

Sect. 2—This code shall be applicable with respect to the production and/or sale of steel castings, regardless of whether the producer or the seller is also engaged in any other industry; provided, however, that this code shall apply to and affect that part of the business only which relates to the industry.

Article IV—Participation

Sect. 1—"Participants in the Code" are those members of the Industry which have undertaken to bear their fair share of the expenses and responsibility of administering the Code, either as members of the Society or by undertaking to pay to the Society the equivalent of the dues they would pay as members of the Society. Any member of the industry may become a participant in the Code by filing with the Society a letter in the form annexed hereto as Schedule A. A non-member of the Society which files such a letter undertakes thereby to pay to the Society amounts equal to the dues which it would pay as a member of the Society.

Article V—Administration

Sect. 1—As long as membership in the Society is open to any member of the Industry on an equitable basis and upon terms of equality with present members, the Board of Directors of the Society shall be the general agency for the administration of this Code and shall

(a) for the purpose of keeping the President informed as to the observance or nonobservance of this code and as to whether the industry is taking appropriate steps to effectuate in all respects the declared policy of the National Industrial Recovery act, require from any member of the industry, in the event of complaint, duly certified reports in such form as may hereafter be required by the Administrator,

(b) upon complaint of interested parties make such inquiry and investigation into the operation of this code as may be necessary, unless a supervisory agency has been appointed as provided in Sect. 1 of Article VII for the subdivision or product classification of the industry to which said complaint relates,

(c) make such rules and regulations subject to the approval of the National Recovery administration as may be necessary for the administration and enforcement of this code.

Sect. 2—It is recognized that questions of public interest are or may be involved in the administration of this Code. Accordingly, three representatives of the Administration (who shall be persons not having or representing interests antagonistic to the interests of members of the Industry), of which the Administrator may be one, appointed by the Administrator, shall be given full opportunity at such times as shall be reasonably convenient to discuss with the Board of Directors or any committees thereof any matters relating to the administration of the Code and to attend meet-

ings of the Board at which action on any such matters shall be undertaken and to make recommendations as to methods or measures of administering the Code. Due notice of all such meetings of the Board of Directors shall be given to such representatives of the Administration. The records of the Board of Directors relating in any way to the administration of the Code shall be open to such representatives at all reasonable times. They shall be afforded by the Board of Directors complete access at all times to all records, statistical material or other information furnished or readily available to the Board of Directors in connection with, or for the purposes of, the administration of the Code. The Board of Directors, acting directly or through one or more committees appointed by it, shall give due consideration to all requests, suggestions or recommendations made by such representatives of the Administration and render every possible assistance to such representatives in obtaining full information concerning the operation and administration of the Code, to the end that the President may be fully advised regarding such operation and administration through reports that may be made to him from time to time by such representatives, and to the end that the President may be assured that the Code and the administration thereof do not promote or permit monopolies or monopolistic practices, or eliminate or oppress small enterprises, or operate to discriminate against them and do provide adequate protection of consumers, competitors, employees and others concerned and that they are in furtherance of the public interest and operate to effectuate the purposes of Title I of the National Industrial Recovery Act.

Article VI—Hours of Labor, Rates of Pay, and Other Conditions of Employment

Sect. 1—Pursuant to subsection (a) of Sect. 7 of the National Industrial Recovery act and so long as the code shall be in effect:

(1) Employes shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purposes of collective bargaining or other mutual aid or protection;

(2) No employe and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing; and

(3) Employers shall comply with the maximum hours of labor, minimum rates of pay, and other conditions of employment approved or prescribed by the President;

(4) Under the foregoing provisions the members of the industry may continue the policy under which the selection, retention and advancement of employes will be on the basis of individual merit without regard to their affiliation or non-affiliation with any labor or other organization.

Sect. 2—

(a) The basic processes in the industry are of a continuous character and cannot be changed in this respect without serious adverse effect upon production and employment. As demand for the products of the industry, and therefore for labor, shall increase, hours of labor for employes in the industry must necessarily increase; but, except in the case of executives, those employed in directing or supervisory capacities and in technical or other highly skilled work, and their respective staffs, and so long as employes qualified for the work required shall be available in the respective localities where such work shall be required, and having due regard for the varying demands of the consuming and processing industries for the respective products, none of the members of the industry shall cause or permit any employe to work at an average of more than 40 hours per week in any 8 weeks' period, such periods to be computed from the effective date of this code, or to work more than 48 hours or more than 6 days in any 1 week.

(b) After the date of the employment by any member of the industry of any employe, such member shall not knowingly permit such employe who shall also have performed work for one or more other employers, to work for such member such number of hours as would result in a violation of the code had all such work been performed for such member.

Sect. 3—None of the members of the industry shall employ in the industry any person under 16 years of age, and no one under 18 years of age shall be employed in hazardous work. Nothing in this section shall be construed to be in conflict with any state laws governing the employment of minors.

Sect. 4—For the purposes of this code, the wage districts described in Schedule B, annexed hereto, have been established.

Sect. 5—

(a) Until changed by amendment of the code as hereinafter in article VIII provided, the minimum rates of pay per hour which shall be paid by members of the industry for general labor in the industry in the respective wage districts described in such Schedule B shall be the rates set forth in Schedule C annexed hereto. None of the members of the industry shall pay general laborers in its employ in the industry in any such district any rate of pay less than the rate specified for such district in such Schedule C.

(b) The rates of pay for classes of labor heretofore paid at a rate in excess of the rate heretofore paid for common labor shall be increased at least to the extent necessary to maintain, in relation to the minimum rates for common labor under the Code, the percentage relations heretofore existing (as determined by the experience of the several wage districts with the approval of the Board of Directors) between the rates of pay for such classes of labor and the rates of pay for common labor. The foregoing provision shall not be so construed as to require any member of the industry to make any increase in the rate of pay per hour to be paid by such member to any of its employes in any wage district that will result in a rate of pay per hour which shall be higher than the rate of pay per hour paid to employes doing substantially the same class or kind of labor in the same wage district by any other member of the industry which shall have increased its rates of pay per hour in accordance with such provisions.

(c) In the case of employes performing work for which they are paid per piece of work performed, the minimum rate of pay which each member of the industry shall pay for such work shall produce at least the minimum rate of pay per hour provided in this code for general labor at such plant.

Sect. 6—The provisions as to minimum rates of pay shall not affect those employes who, by reason of age or infirmities, are not engaged in productive labor, except that the rates now paid such employes shall not be less than 80 per cent of said minimum rates and the number of such employes employed by each member of the industry shall not be more than 3 per cent of the total number of its employes.

Article VII—General Provisions

Sect. 1—Members of the industry having a common interest and common problems may group themselves for administrative purposes in various subdivisions or product classifications, subject to the approval of the board of directors. The majority of members in each subdivision or product classification may appoint its agency, with supervisory and/or administrative powers, subject to the board of directors. In the event that no such agency is appointed, then the board of directors may appoint such agency. If formal complaint is made to the board of directors that the provisions of this code have been violated by any member or members of the industry, the agency for the subdivision or product classification to which the complaint refers, shall institute such inquiry as may be necessary to develop the facts.

Sect. 2—If the agency of any subdivision or product

(*Please turn to page* 43)

Four Foundry Codes Are Filed

Formal hearings probably will be held during month starting with Steel Sept. 7

EVERY group of the foundry industry has on file in Washington a code of fair competition complying with Title 1 of the National Industry Recovery act. The Steel Founders' society is the first upon which the hearing date has been set. The public discussion of the steel foundry code which is presented on page 13 of this issue was scheduled for hearing under Deputy Administrator H. O. King. The matter of geographical wage districts is of interest to all foundries operating in various centers where steel castings are manufactured. These wage districts, as will be noted, have taken into consideration competitive areas and geographic divisions where lower cost of living obtains. Provision is made for representatives of the N. R. A. administration, three in number, to advise with the board of directors of the Steel Founders' Society of America in matters relating to the code and its operation.

The clear differentiation between miscellaneous castings and specialty groups is carried through all considerations of the code and is particularly noteworthy in the unfair trade practices set forth as appendixes to the general code. Furthermore, administrative and supervisory power is conferred under the organization of subdivisions or product classifications.

Revision Under 10 Day Notice

The latter provision is the basis upon which provision is made for filing of price lists showing current prices upon standard classes of castings. These price lists are to be filed and become effective upon a specified date. Revision may be made by giving 10 days' notice to foundries coming within the individual classification directly concerned with the proposed revisions. The code specifically sets forth the principle that no member of the industry within a subdivision coming under one of the price classifications shall sell directly or indirectly any product within a subdivision at a price less than the price shown on the list filed by such member.

This plan, an effective application of the open-price system, provides against indiscriminate price cutting and provides a lower limit upon the descending spiral of castings prices. It is in no sense an attempt at price-fixing, but rather a stabilizing measure sadly needed in many branches of the foundry industry.

The Malleable Founders' society, the formation and organization of which was noted in THE FOUNDRY for August, has prepared and filed a code with the assent of 92 per cent of the producing capacity of the malleable foundry industry. This code, subject to further discussion by the administration and the code committee of the society, probably will be advanced to hearing early in September. By reason of the concentration of the malleable industry within more limited areas and territories, the wage district plan is subject to different consideration.

Embrace Larger Average Units

Both the malleable and steel foundry groups embracing larger average units and a smaller number of foundries, have been able to facilitate measures leading to the preparation and submission of the codes. Furthermore, a predominance of jobbing interests among the producers of both steel and malleable castings has brought a more ready realization of trade problems and other considerations upon a common basis.

The gray iron foundry industry, far flung both in distribution of plants and in variety and character of product and uses, has encountered a slower development, but with a sizable nucleus the Gray Iron Steering committee has prepared and filed a code providing for employment conditions and taking cognizance of merchandising and marketing practices. This code has been accepted by representatives of 17 different geographical districts, has been discussed in detail at open meetings and has been compiled with the advice and guidance of many close to the administration and well informed as to the intent and purposes of the N.R.A. Some foundrymen who have been most closely associated on this work and who have given of their time unselfishly in endeavoring to provide a vehicle for participation by the entire gray iron industry have been discouraged by the lack of response. This may be ascribed entirely to the lack of time and facilities possessed by many foundries not in large centers that failed to (*Please turn to page* 40)

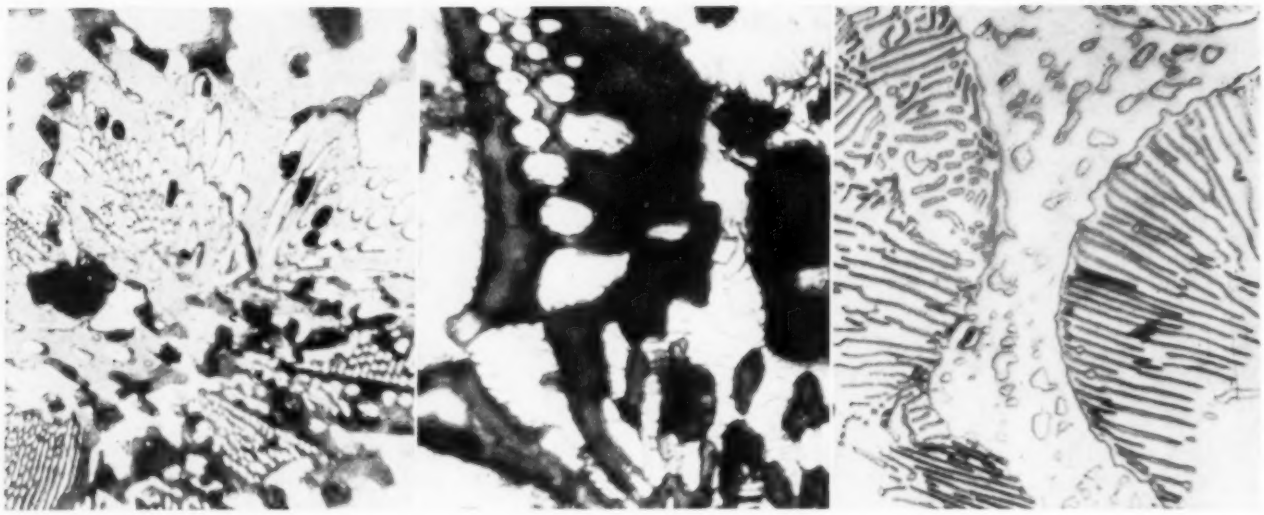


Fig. 6—(Left) A 1.90 phosphorus iron etched in hot sodium picrate, X1000. Fig. 7—(Center) Another high phosphorus iron, etched in hot sodium picrate, X2000. Fig. 8—(Right) An iron showing a white steadite structure etched with 2 per cent bromine in amyl alcohol, X2000

Phosphorus in Cast Iron—II

Lowers rigidity and impact value and under certain conditions increases the hardness

By JOHN W. BOLTON

Lunkenheimer Co., Cincinnati

STEADITE, the phosphorus rich structure, is the last portion of the casting to solidify. Therefore, if often is found as a network around the grain boundaries. The occurrence of phosphorus network in some strong irons led Cook and Hailstone to the conclusion that phosphorus network is an essential to high strength.

In THE FOUNDRY, Oct. 1, 1922, the author presented evidence that strong irons can be produced without phosphorus network. He also showed that many weak irons may have a pronounced network formation which refutes the conclusions mentioned.

Irons low in phosphorus have little tendency toward network formation, although many of the strongest metals are found in this class. When phosphorus is low there is not enough steadite to form a network. When phosphorus is fairly high and cooling is slow, the steadite tends toward segregation in large isolated dendrites, rather than toward the formation of networks.

Slow cooling also promotes grain growth and weak iron. Hence the absence of network in higher phosphorus irons is evidence of cooling conditions which produce weak irons. Thus, to say that phosphorus network is essential to high strength is equivalent to putting the cart before the horse. In higher phosphorus irons the presence of a steadite net work is secondary evidence of cooling conditions favorable for strength.

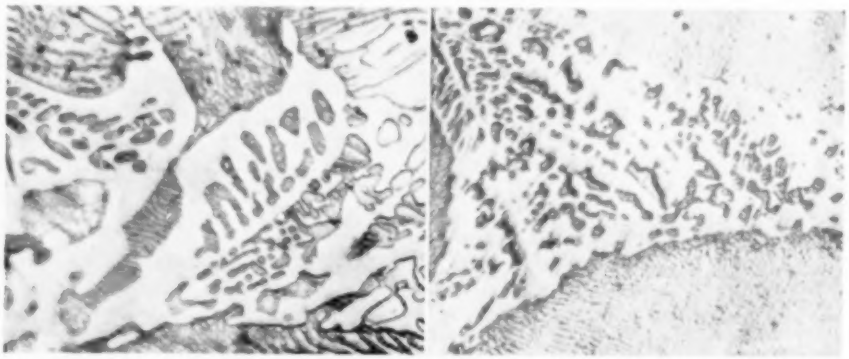


Fig. 9—(Left) Steadite particle, relief polished, X600. Fig. 10—(Right) The white structure with cellular spots showing pearlite laminations is steadite, etched with pitric acid, X2000

Steadite in itself is not a strengthener. The first small additions of phosphorus may increase the strength slightly. Fracture can pass right through the steadite, as has been shown by the author in previous papers. That the fracture does not go around the steadite crystals, is positive proof that the network theory is without foundation. The final conclusion is that phosphorus is not a true strengthener under foundry conditions.

(d) Phosphorus does not lower the rigidity of cast irons at intermediate loads, according to Mackenzie in *Transactions* of the American Foundrymen's association—1925, but it does lower their ultimate deflection, as reported by J. W. Bolton, *Transactions* for 1925. That deflection at 1500 pounds load on a 2 x 1 x 24-inch bar depends more on (per cent carbon plus percent silicon) than on phosphorus

$$\frac{\text{carbon plus silicon}}{4}$$

content is shown by MacKenzie's chart, Fig. 11. The effect on deflection is shown in Tables I and II and Fig. 12 by Bolton.

Table I

Summary of Data Showing Relationship of Phosphorus to Deflection

Deflection in Inches	No. of Test Bars Broken	Average Total Carbon Per Cent	Average Silicon Per Cent	Average Phosphorus Per Cent	Average Manganese Per Cent	Average Sulphur Per Cent	Average Transverse Strength	Carbon and Silicon
0.090	4	3.27	1.16	0.480	0.53	0.096	3888	4.43
0.095	2	3.53	1.28	0.478	0.42	0.159	4000	4.81
0.100	8	3.30	1.31	0.431	0.50	0.097	3698	4.61
0.105	8	3.36	1.34	0.448	0.48	0.100	4050	4.70
0.110	9	3.36	1.29	0.428	0.55	0.115	4318	4.65
0.115	7	3.31	1.27	0.392	0.58	0.120	4099	4.58
0.120	22	3.31	1.31	0.360	0.51	0.119	4305	4.62
0.125	10	3.37	1.46	0.358	0.64	0.122	4253	4.88
0.130	14	3.23	1.29	0.262	0.54	0.138	4402	4.52
0.135	8	3.42	1.27	0.271	0.60	0.106	4366	4.69
0.140	10	3.31	1.31	0.256	0.60	0.126	4223	4.62
0.145	5	3.39	1.30	0.291	0.48	0.131	4005	4.69
0.150	2	3.24	1.12	0.240	0.54	0.125	5055	4.36

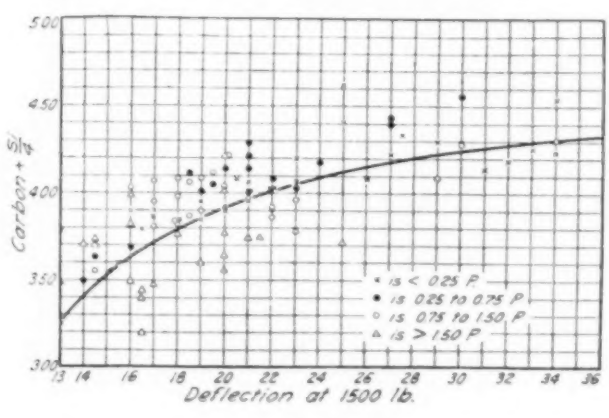
Table II—(No Steel in Mixture)

Deflection in Inches	No. of Test Bars Broken	Average Total Carbon Per Cent	Average Silicon Per Cent	Average Phosphorus Per Cent	Average Manganese Per Cent	Average Sulphur Per Cent	Average Transverse Strength	Carbon and Silicon
0.085	1	3.69	1.90	0.570	0.72	0.098	2900	5.59
0.090	4	3.62	1.84	0.595	0.67	0.104	3135	5.46
0.095	5	3.57	1.75	0.475	0.70	0.106	3260	5.32
0.100	9	3.59	1.72	0.542	0.70	0.114	3355	5.31
0.105	7	3.61	1.72	0.465	0.66	0.125	3209	5.33
0.110	12	3.59	1.81	0.441	0.59	0.133	3320	5.40
0.115	8	3.43	1.77	0.474	0.62	0.115	3440	5.20
0.120	6	3.60	1.73	0.442	0.63	0.130	3375	5.33
0.125	4	3.58	1.67	0.362	0.58	0.126	3288	5.25
0.130	4	3.59	1.75	0.365	0.58	0.124	3075	5.34

(e) It has been recognized for a long time that phosphorus lowers impact value—a natural consequence of a brittle component occupying considerable volume in the metal. Among many comparisons the following is typical. The iron whose composition (1.99 per cent phosphorus) and tensility were mentioned in paragraph (c) had an Izod impact of 2.17 foot pounds. A notoriously weak iron 3.95 per cent total carbon, 1.90 per cent silicon, 0.07 per cent phosphorus cast at approximately the same temperature in the same type of test bar had a tensile of only 18,300 pounds per square inch, yet its Izod impact was 4.14 foot pounds. These data are from the American Society for Testing Materials investigation of impact, presented at the 1933 convention in Chicago.

(f) Under certain conditions phosphorus decreases machinability and increases hardness. Stead showed that the binary eutectic has a Moh's hardness of 5.5, which is nearly equal that of quartz sand (6.0).

The author obtained a brinell reading of 418 for an iron containing 4.8 per cent phosphorus. The brinell of the strongest semisteel rarely runs much over 250. In Fig. 9 the hardness of



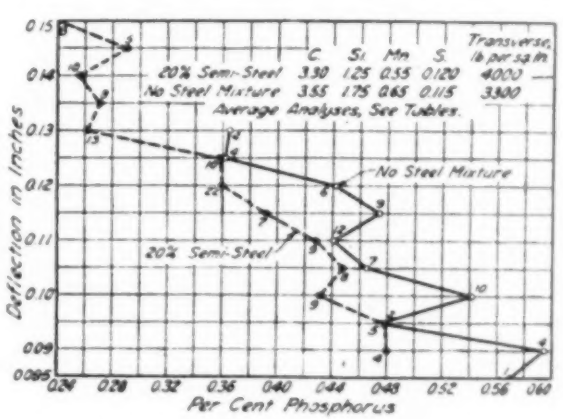

Deflection in Inches
Per Cent Phosphorus
Transverse, lb. per sq. in.
20% Semi-Steel C 3.30 Si 1.25 Mn 0.55 S 0.120 4000
No Steel Mixture 3.55 1.75 0.65 0.115 3300
Average Analyses, See Tables.
No Steel Mixture
20% Semi-Steel

Fig. 11—(Left) MacKenzie's chart showing relation between deflection and the sum of carbon plus one-fourth the silicon. Fig. 12—(Right) Chart showing the relation of phosphorus to deflection

steadite is shown by relief polishing. In this method the sample is buffed a long time against a soft backing. The softer portions are worn away, while the harder portions stand out in relief. As shown in the illustration the steadite particle stands in relief, being harder than the rest of the specimen.

Hardness Shown by Scratch

The hardness of steadite can be shown by drawing a needle across a polished specimen of iron. On examining with the microscope, the scratch across the steadite will be narrower than it is on the rest of the metal, indicating the hardness of the phosphorus-rich structure.

In strong irons the phosphorus-rich formation, steadite, frequently acts as an abrasive. It greatly shortens tool life, and hence lowers machinability. In a number of instances the author has confirmed that the tiny, hard steadite crystals destroy the tool edge quite rapidly. In two cases, on widely variant classes of castings, strong iron was made unmachinable by phosphorus being raised from 0.30 to 0.60 per cent. Other conditions equal, in another instance, a firm was enabled to machine low-phosphorus, high test metal successfully where before it had been unable to use high test metals of higher phosphorus.

In low strength irons, the abrasive effect of phosphorus is not so marked and in fact it may be negligible. The abrasive crystals are held in a softer backing or matrix, and are pushed out of the way in machining.

As an illustration, consider quartz sand as steadite. Sand imbedded in caramel candy or other soft backing, let us say, corresponds to steadite in weak iron. Sand glued to strong paper corresponds to steadite in strong iron. One may cut wood readily with the sand held on sandpaper, but cannot make much progress with the sand-caramel block. It is the same sand in both cases, but the abrasive action depends on the rigidity with which the hard material is held. The same applies to phosphorus in weak and strong irons. Hamasumi's researches previously mentioned showed that hardness increased directly with phosphorus content.

Matrix Determines Wear Resistance

(g) Increase in phosphorus may or may not be detrimental to wear resistance. The hard component, steadite naturally resists abrasive wear and if it is held rigidly in a suitable matrix, wear resistance may be good. This condition prevailed in Piwowarsky's experiments presented in *Die Giesserei*, No. 43, 1927, where the steadite was held in a pearlitic matrix. Using a spindle machine, the irons being pressed against sheet steel without lubrication, and an Amsler machine with the counter disk made of "piston ring cast iron," with lubricant used, Piwowarsky found that increases in phosphorus from 0.07 to 0.70 per cent maximum resulted in steady lowering of *wear*.

Because of the phosphorus network, high phosphorus irons are likely to be abrasive to other metals. Furthermore, if the steadite is not held rigidly in the matrix, the hard brittle particles frequently break off, causing a severe grinding action.

The author has shown that in iron decomposed by acids, phosphides were attacked more slowly than most other components. The order of corrodibility is as (*Please turn to page* 52)

Phosphorus Effects on Iron

PHOSPHORUS content in pig iron depends upon the ores used, and the content in the iron is changed but slightly in cupola melting.

In gray irons phosphorus is found largely as an eutectic form, containing about 10 per cent phosphorus and 90 per cent iron. The phosphorus rich "crystals" (largely of eutectic formation) are called steadite.

One per cent of phosphorus gives about 10 per cent of steadite by volume.

Steadite is hard and brittle. Its specific gravity is not far from that of ordinary gray cast iron. It is fluid, melting at about 1800 degrees Fahr. Under some conditions this fluidity increases the "running" capacity of cast irons.

Phosphorus lowers the initial freezing point of gray iron quite materially.

Phosphorus lowers the carbon eutectic carbon percentage and the tendency of iron to absorb carbon. This action is not marked in irons of ordinary commercial analysis. Phosphorus has little or no effect on the critical or pearlitic point.

In commercial irons steadite is the last component to solidify. Hence, the tendency of medium and high phosphorus irons to show network formation. These formations do not increase the strength or intermediate rigidity but they do lower the ultimate deflection.

Phosphorus is a hardener, giving the property of abrasive hardness. This is noticeable particularly in strong irons. Therefore, low phosphorus should be used to obtain strong, readily machinable castings.

Tendency toward shrinkage defects usually is increased by increase in phosphorus content.

Steadite itself resists acid corrosion and the penetration of corrosive fluids.

The use of lower phosphorus irons is finding more general favor. Phosphorus is a "nuisance" element, under some conditions relatively harmless, but under others quite detrimental to soundness, machinability, strength, and toughness.

Subdivides Cleaning Costs

Classification according to respective operations provides valuable information

By PETER E. RENTSCHLER

Hamilton Foundry & Machine Co., Hamilton, O.

THE only one way to clarify cleaning costs is to divide them or break them down into the respective operations. While this break down of operating subdivisions in the cleaning department may seem like a complicated problem in costing compared with the ease of a single departmental total cost, the detailed results reached for each cleaning operation are so worthwhile that the extra clerical work involved is more than compensated for by the information afforded.

Once the subdivisions in the department are set up, the costs can be computed on a routine basis, because the basic figures, as set for each subdivision, will more than likely remain unchanged for at least a year or perhaps longer, depending upon the individual local conditions as to the allocation of the buildings and equipments utilized for the subdivision.

Therefore it is necessary that each subdivision be defined, definitely and clearly and that the classification of accounts used for the costs be set up to provide for the segregation of the various cost items to the cleaning subdivisions. A comparison can be made of the departmental total with each classified subdivision by the summarizing or consolidating of the subdivided costs at the conclusion of each subdivision costing.

The cleaning costs, which we in our own foundry set up, cover both the cleaning and shipping, and are:

Mill sandblasting
Hand sandblasting
Tumbling
Pickling
Grinding
Finishing
Shipping

Depending upon the character of the work a foundry is doing, these subdivisions either can be reduced or enlarged upon, but for our light class of work, these detailed subdivisions cover all the classes of castings.

A number of our castings go through more than one of the actual surface cleanings, in that certain tumbled castings may have to be sandblasted in pockets prior to tumbling, to clean certain cavities thoroughly that the nature of the casting would not permit proper cleaning in a tumbling barrel.

There are so many variations in the castings that go through the respective subdivisions that it is difficult to lay down hard and fast rules. For instance, we have only a nominal amount of chipping (hand or air) and this chipping direct labor, etc., is included in our Finishing division.

Our classification of accounts provide for the following items.

1. Direct Labor
2. Indirect Labor
3. State Liability Insurance
4. Miscellaneous Supplies and Tools
5. Repairs (Labor and Materials for all Repairs)
6. Fixed Charges (Taxes, Insurance, Depreciation Buildings and Equipment)
7. Heat-Light-Power
8. Plant General Expense
9. Selling and Administrative General Expense

Each one of our subdivisions, previously mentioned has all of these items of cost. Such items as may require an explanation of details are as follows;

Mill Sandblasting Division:

1. Direct labor
   Mill operators
2. Indirect labor
3. State liability insurance
4. Miscellaneous supplies and tools
   Blasting abrasives
   Hose
   Nozzles
   Rubber washers
   Brooms
   Lubricants
   Waste
   Electric Bulbs, etc.
5. Repairs
6. Fixed charges
7. Heat-light-power
8. Plant General expense
9. Selling and administrative General Expense

Hand Sandblasting Division:

All items as under Mill Sandblasting except

1. Direct labor
   Hand operators
4. Miscellaneous supplies and tools
   Blasting abrasives
   Hose
   Nozzles
   Helmets
   Respirators

(Please turn to page 56)

Casting Beryllium-Copper Alloys

Experiments show physical properties of sand castings following heat treatment

By EDWIN F. CONE

BERYLLIUM, originally named glucinum, is a comparatively new alloying element recently introduced to metallurgists. Some of the properties which it bestows as an alloy are exceedingly interesting and are attracting wide interest in several industrial fields. Development is in its early stages, but enough investigation and progress have been made in this country and in Europe to warrant the prediction that the metal will play an important role in industry.

Beryllium resembles the aluminum-magnesium family in some of its properties. It is one-third lighter than aluminum and one-sixteenth heavier than magnesium. Put in another way, it is about 35 per cent lighter than aluminum, having a specific gravity of 1.85 and a melting point of about 2335 degrees Fahr.

Actual foundry production in this new field, on a somewhat limited scale, has been conducted by the American Manganese Bronze Co., Holmesburg, Philadelphia, where commercial orders for certain types of products of beryllium bronzes have been filled and some experimental investigative work also has been conducted.

To introduce definite percentages of beryllium into a copper product, a 12.5 per cent master alloy is obtained from the producer, who furnishes the exact beryllium content with each shipment. This alloy is brittle in its high state of concentration and can be broken easily into suitable pieces for addition purposes. The calculation of the charge is made according to the following formula:

$$\frac{T\,Be_2}{Be_1} = \text{pounds of master alloy.}$$

where T = total pounds of metal desired,
Be_2 = per cent beryllium desired in final product, and
Be_1 = beryllium in master alloy.

Table I

Physical Tests of Beryllium-Copper Alloys

Per Cent of Beryllium	Elastic Limit, lbs. per sq. in.	Tensile Strength, lbs. per sq. in.	Elongation in 2 in., per cent	Reduction of Area per cent	Brinell No.
"As Cast" Condition:					
1.79	47,130	60,200	5.0	11.6	119
1.79	38,200	63,400	9.0	13.1	100
1.36	33,400	41,500	4.0	9.7	136
2.19	43,600	62,200	14.0	20.0	109
2.19	39,100	47,100	7.0	13.0	93
2.19	51,800	72,200	10.0	22.0	158
Annealed Condition:					
1.67	16,810	41,100	29.0	31.4	54
1.79	15,800	33,400	16.0	22.2	65
2.19	22,800	39,250	11.0	22.0	86
2.19	22,150	40,600	13.0	25.0	70
2.45	28,400	57,200	6.0	13.0	143
Precipitation Hardened at 575 degrees Fahr. for 3 hours:					
1.79	39,000	71,100	3.0	5.5	119
2.19	84,800	104,000	1.0	0	444
2.19	87,600	116,600	1.0	0	415
2.45	93,400	117,300	1.0	0	415
2.45	97,700	117,000	1.0	0	415
Precipitation Hardened at 575 degrees Fahr. for 24 hours:					
2.00	20,790	106,300	1.0	...	...
1.67	49,300	69,600	3.0	3.1	183
1.79	74,200	95,400	2.0	1.2	207
2.50	83,200	100,000	1.0	0	269
1.57	75,600	91,300	2.0	0	321
1.57*	74,200	99,600	3.0	0	331

*Heated for 7 hours.

In producing a beryllium-copper alloy casting, the copper is dead-melted in a clay graphite crucible under a heavy covering of charcoal. An electric furnace can be used. The melt is deoxidized thoroughly with baronic copper, calcium, lithium, silicon or magnesium. Practice of the American Manganese Bronze Co. is to use boronic copper. Free boric acid should not be used, although glass borax in the charcoal covering may be employed as additional protection on the exposed metal.

Table II

Heat Treating Effect On Hardness of Two Alloys

Specimen	Time, hrs.	525 degrees Fahr. — Beryllium, 1.85 per cent	525 degrees Fahr. — Beryllium, 2.35 per cent	575 degrees Fahr. — Beryllium, 1.85 per cent	575 degrees Fahr. — Beryllium, 2.35 per cent
A	1	112	312	107	269
		B72	B109	B67	B102
B	1½	145	269	137	340
		B75	B106	B78	B112
C	2	297	302	156	293
		B98	B107	B104	B110
D	2½	241	302	302	375
		B130	B109	B107	B112
E	3	259	351	302	302
		B102	B111	B107	B114

Figures for Rockwell hardness indicated by B; Brinell hardnesses have no indicating letter.

To offset the cooling effect produced by the addition of the master alloy, the bath of pure copper is heated to just above 2200 degrees Fahr. before additions. After the additions of small pieces of the 12.5 per cent alloy, the bath is stirred with a graphite, plumbago or nichrome rod, using special care so that the alloy does not float on top. Too active stirring is to be avoided because of the unfavorable effect due to absorption of gases.

Keep Pouring Temperature Low

The next point is to bring the bath by cooling or heating to the pouring temperature, which should be as low as possible—from 1900 to 2000 degrees Fahr. is recommended by the alloy producing company. The practice at the Holmesburg foundry is to keep the temperature for pouring as near 2000 to 2100 degrees Fahr. as possible, avoiding the necessity of reheating to achieve the desired result. Careful pyrometric control and good foundry practice have made this possible.

The alloy then is cast according to usual methods. Pouring should take place as soon as practicable at the proper temperature after additions of the master alloy. Pouring too hot with relation to the job in hand should be avoided, and at too low a temperature unfavorable results follow. All pouring operations are conducted with a charcoal covering on the metal.

Sand casting practice is that usually followed for castings. For metal to be subsequently fabricated, chill molds are preferable. If cast iron molds are used they should be cleaned thoroughly, warmed to about 250 to 300 degrees Fahr. and dressed by a coating of soot obtained by customary methods.

Practice at Holmesburg, where heats of 200 pounds are made, is to use green-sand molds. Heading and gating are simple, the practice usually following that for aluminum or phosphor bronze. Size of heads and gates approximate those used for phosphor bronze and are only about one-fourth the size necessary for aluminum bronze; that is, the shrinkage is much less than for aluminum bronze, approximating that of phosphor bronze. Linear shrinkage has been found to be about 3/16 inch per foot for the 2.5 per cent beryllium alloy.

The melting loss on 200-pound lots is about 9 per cent for both the beryllium and the copper. Rejections have not exceeded 2 per cent. Castings come out clean, smooth and sound in most cases and have a golden copper color.

Because of its inherent deoxidizing power, beryllium is recommended strongly for that purpose in making copper castings, in addition to its use as an alloying agent. Standard practice is to add 0.01 to 0.02 per cent beryllium, either alone or, preferably, following standard deoxidizers such as baronic copper, to copper and copper-base alloys. Experience reveals the fact that the soundness of such castings, as well as their machinability and workability, will be improved measurably and clean, sound castings free from imperfections secured. If percentages of beryllium up to 0.05 to 0.10 per cent are employed, further improvement of machinability is claimed to result.

Metal Is Heat Treated

Heat treatment of the beryllium-copper alloys is interesting and important. In general, the beryllium-copper after casting should be held at a maximum of 1475 to 1500 degrees Fahr. for at least 2 hours. This insures the complete solution of any precipitated beryllides. The mass and shape of the casting will determine the length of time required, which is also increased as the percentage of beryllium increases. Because the disintegrating temperature of beryllium-copper seems to lie somewhere around 1550 degrees Fahr. or slightly above, the temperatures of 1475 to 1500 degrees Fahr. should be regulated carefully by pyrometric control.

After soaking at this temperature, the product is quenched in cold water which should be accomplished as soon as possible, after which it will be found to have (*Please turn to page* 59)

Cast Steel in Europe and America

Comments on article in which naval officer discussed steel foundry practice in Europe

By PAT DWYER

THE report of Capt. Louis Shane covering his inspection of steel foundry practice in Europe, as presented in the February issue of the *Journal of the Society of Naval Engineers*, was accompanied by comments of a number of individuals familiar with practice in Europe and America. George Batty, technical director, Steel Castings Development bureau, in discussing the paper, claimed that the comparison drawn between steel casting production here and in Europe is definitely adverse to American foundries, notwithstanding the final statement of the author that steel foundrymen on this side of the Atlantic now reveal a real change of attitude from that which prevailed a few years ago.

Low Prices Mean Low Quality

Certain makers of steel castings in this country insist that a user of steel castings is entitled only to what he pays for, according to Mr. Batty. If a low price is paid, only a low grade quality justifiably may be expected. Practical experience has shown that the practical man in the foundry—the foreman or superintendent—is burdened with a cost limitation when he embarks upon the production of keenly cut-price castings incident to a system which insists on the acceptance of the bid of *the lowest reputable bidder*. To retain his job the man in charge of operations cuts corners and thereby cuts quality.

This is rank unfairness to the practical man and to this unfairness is added the indictment that he is incompetent and necessarily must be supported and buttressed by scientists and technicians to produce even passable castings. This is no argument against the employment of the technician, but is a defense of the practical foundryman who can—and on many occasions does—produce excellent steel castings under difficulties.

Mr. Batty maintains that scientific and technical control of the various details of procedure in the production of steel castings is available in American foundries. The assumption that European technicians are superior to those in the United States is not necessarily correct. Surveying the work of Bull, Hall, Herty, Lorenz, Melmoth, Simms and Lilliequist—to mention only a few—he believes that this country is equipped adequately to produce steel castings equal to the best obtainable elsewhere.

Injection of the scientist and technician into the foundry industry is welcomed by all intelligent, practical foundrymen. Nondestructive inspection of castings by the x-ray or gamma-ray will result in improved foundry technique and in a superior product. A few years ago H. J. French remarked that the foundry industry was afflicted with a multitude of opinions and was deplorably lacking in facts; a statement that was and is lamentably true. It always will be so, according to Mr. Batty, because no matter how much we know there is still so much more to be known. Mr. French's opinion was expressed in particular reference to an American foundry investigation, but in the light of Captain Shane's paper, it applies equally to European foundries. For example one manufacturer uses a large number of internal chills while another declines to use this type of chill and prefers to use enormous risers to promote soundness.

Does Not Favor Internal Chills

The question of the relative merits of internal chills as compared with external chills is something more than a mere difference in technique. Mr. Batty maintains that the use of internal chills is a definite encroachment upon the potential qualities of the cast metal. Cast-in chills should not be used when their use may be avoided by the application of external chills, or, by a modification of the gating and heading factors. Modification in design may eliminate to some extent the necessity for the use of chills. Also a reservation must be made in the case of such things as bosses where an integral chill later is removed entirely through a machining operation.

Delivering feed metal to certain heavy sections of a casting is not always practicable and resort has been made to the use of internal chills with what appears to be satisfactory results.

Mr. Batty prefers external chills, but is impressed by Captain Shane's statement that presumably satisfactory castings are made in one foundry where an enormous number of small integral chills are used. However, he wonders what the physical properties are at certain heavily chilled parts of the casting and it would be interesting to compare these with the physical properties cited as acceptance minima on test pieces which must be composed entirely of cast metal.

Mr. Batty points out that a somewhat startling deviation from ordinary procedure is cited in Captain Shane's statement that at Feignies *two barrels of water were upset on the risers* immediately after the ladle had left the mold. It is difficult for him to accept the suggestion that feeding was complete within a few seconds if the casting was of heavy section. If, by any careful adjustment of pouring speed and temperature it could be possible to accomplish the whole of the *liquid contraction* during the pouring operation, the two large risers mentioned would appear to represent nothing but waste of molten metal.

In Mr. Batty's opinion unless the pouring temperature is very low there must be some considerable change in volume of metal in the mold before solidification is complete. The normal function of the riser is to deliver metal to the casting to compensate for this change in volume. It seems possible that the Feignies casting may be afflicted seriously in places with internal defects of the type under investigation by Briggs and Gezelius. However, it may be that the functioning of the risers is not seriously impaired by having the water thrown upon their upper surfaces and that the explanation offered to Captain Shane is merely an opinion and not a fact.

Deplores Hurrying Melting Process

Some of the listed criticisms are justified according to Mr. Batty's experience. In particular he admits that European foundrymen are correct in deploring the American system of hurrying production processes. Cleaning the steel in melting practice, to some extent is a function of time.

He is interested to note the comment "Fluidity is not necessarily obtained at the same temperatures." He thinks Melmoth was the first to note the abnormality in electric steel as compared with acid open-hearth and converter steel, which has come to be known as the *over reduced condition*. Foundrymen in this country are not unaware of these phenomena. In many foundries tests are made to determine not only the temperature of the metal, but the fluidity and the ability to stand exposure to the atmosphere in the process of delivering metal to the molds, or exposure to the atmosphere in the molds in the process of running the casting either in green or dry sand molds.

Mr. Batty does not claim that American foundries are operating under conditions that approach the ideal. He directs attention to the fact that Captain Shane makes an excellent point when he reveals the European practice of having the founder produce the pattern in a manner peculiarly suitable to the system upon which the foundry will produce the casting. So many buyers of steel castings in this country wish to buy the cheapest possible type of pattern, nothing more than a wooden replica, slightly enlarged of the proposed casting. Thus to the indictment of indecent haste we have added the indictment of deplorable and dangerous parsimony, masquerading in the guise of virtuous economy.

Practitioners Responsible for Variation

Essential reactions in the physical chemistry of steel making are conducted in practically the same manner in each acid process. The variation in the quality of the product more justifiably might be attributed to the practitioners than to the process. For example, the converter process has been attacked in the United States. Captain Shane notes that "The French government does not permit any converter steel to be furnished and except for unimportant castings, converters are not used even for commercial work." Yet the same report quotes the physical properties attained in the convertor metal of an English foundry which would be considered excellent for steel of that composition made by any process.

Incidentally, the augmentation of quality followed the application of materials devised by Dr. C. H. Herty, Jr., and associates in recent investigations. Apparently the American technician is not lacking the honor of acknowledgment abroad.

Comparisons have been made of acid open-hearth steel and acid electric steel, but the fact that consistently acid electric steel can be made better than acid open-hearth steel—or vice versa—would be distinctly difficult to establish according to Mr. Batty. The same potentialities in general current practice do not obtain in a comparison between basic electric and basic open-hearth steel. The basic electric furnace is peculiarly suitable for the production of refined steel from relatively poor grade base materials high in sulphur and phosphorus.

In basic open-hearth practice Mr. Batty points out it is not safe to produce strongly reducing conditions which promote the release of phosphorus from the slag. As a fairly general rule the metal from the basic open-hearth furnace is tapped to the ladle in an appreciably oxidized condition, and is deoxidized in the ladle. This procedure does not tend to the production of the cleanest possible steel, nor to the greatest regularity of composition. (*Please turn to page* 62)

Questions and Answers

Covering important problems found in all phases of modern foundry practice

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the following advisory staff: Steel, John Howe Hall; Malleable, H. A. Schwartz; Gray Iron, John W. Bolton; Nonferrous, N. K. B. Patch

Heavily Leaded Bronze Should Not Be Superheated

We would appreciate receiving information as to how heavily leaded bronze is handled and what flux is used. Also, what protection is used to keep the metal from cutting into the cores?

As you no doubt are aware, these heavily leaded bronzes must be poured at a very low temperature so that solidification takes place without undue delay. It is further important not to overheat the alloy any more than is absolutely necessary above the actual pouring temperature. To superheat it and then chill by adding gates and risers or other solid pieces of metal to bring it down to the pouring temperature, is not good practice, as super-heating tends to increase the amount of dissolved gas. The dissolved gas is thrown out of solution by the solidification and in doing so passes out of the metal, opening up passages for the lower melting point constituents, which cause lead sweat and a consequently unsatisfactory product.

We do not know of any fluxing that is of much use in correcting the trouble brought about by overheating. The better practice is not to overheat and yet to melt as rapidly as possible.

A mixture that will produce a good hard core is desirable. The core, of course, should be open, although the surface of the core can be made very hard by rubbing the dry surface with a mixture of graphite and oil, after which the core again should be dried to drive off any gas that would otherwise be present, and cause trouble during casting. It is difficult to specify details regarding such cores, as every foundryman has his own preference for certain types of sand and core mixtures and due to his local condition, gets better results from a particular mixture made differently from that preferred by another. Therefore, a little experimentation on the part of a given foundry is the best solution of the problem.

Piston Castings Show Cracks on Thin Skirt Edge

We are making a 6-inch piston in which hair line cracks in the skirt condemn about 25 per cent of the daily output. Castings are molded head down, four in a mold under covering cores and gated at the top. The head and ring stock sections are about ¾-inch thick while the side wall is only about ¼-inch.

We believe the radical difference in metal sections of the casting and consequent wide difference in temperature is responsible for the cracks in the skirt. Manifestly where the pistons are cast head down a green sand core cannot be employed. However, a certain measure of relief may be secured by using a dry sand core that will offer a minimum amount of resistance. The amount of binder may be reduced and the body of the core made as a shell instead of solid.

Iron Castings Develop Inner Cavity Shrinkage Defect

We are forwarding for your inspection a small cast iron pump body casting sawed in two to show the character of an internal defect. We made a dozen of these castings which machined perfectly and showed no defect of any kind. The second batch was defective. Every casting disclosed a cavity of greater or lesser area which only came to light at the close of the machining operation. Not a single change was made in materials or in routine of production and yet the first 12 castings were perfect while the second 12 were defective.

Because of the manner in which the cores rest in the prints this casting was molded with a high boss in the cope side. This is one reason

for the defect, a quite pronounced shrinkage cavity. A supplementary reason probably is that the pouring head likely was not built up a few inches to compensate for height of the boss in the cope. The machined surfaces of the casting show a fine, clean metal structure, indicating that the metal mixture, the cores and the skim gates are satisfactory.

The casting develops a cavity defect because the small strainer gate, and the low head cannot supply metal to compensate for the natural shrinkage. Were the casting molded in the opposite position, the chances for a solid casting under the same head and gate would be improved greatly. However, since convenience of operation probably will induce you to continue the present method, further shrinkage cavities can be prevented by raising the pouring head about 3 inches and by placing a 3-inch diameter feeder on top of the high boss in the cope.

The apparent mystery of why 12 castings are defective and 12 castings made under the same conditions are satisfactory is explained by the statement that the cavities in the satisfactory castings were not revealed. The cavities may or may not be located at points that never will interfere with the operation of the pumps, but without doubt they are present some place in the castings.

Nonferrous Alloy Absorbs Gases During Melting Process

From time to time we run into the difficulty of the thread tearing off a 2-inch closet spud. We melt in an oil furnace, and the composition is as follows: Two ingots No. 2 red brass, one ingot of yellow brass with one ounce of phosphor copper to 100 pounds of metal.

Examination of the casting reveals a typical example of brass that has absorbed gases during melting. It also is possible that a small percentage of aluminum may have crept into the alloy, either as an impurity in the ingots or from some other source. A small percentage of aluminum might cause some such trouble, although it would not be as aggravated as indicated by your sample casting.

To correct the situation of absorbed gases, it is imperative to provide the necessary oxygen during melting to insure complete combustion of all gases. This is the only means of correction as a gas that has been burned completely is not soluble in the brass. Hydrogen and some of the unburned hydrocarbons are the most prolific sources of trouble. These are present in the fuel oils, coke and coal that are commonly used as fuel. To insure their complete combustion, an ample supply of oxygen must be made available, and if an ample supply of oxygen is available, the speed of melting will be increased by the increases in temperature derived from complete combustion. Therefore, it is apparent that slow melting is usually indicative of under combustion and tendency to gassing. The faster the melting takes place, the surer one may be that the gases present are insoluble.

The mechanics of the development of the type of imperfection shown in the sample casting are as follows: A thin layer of brass solidifies against the core and likewise a thin layer of brass solidifies against the mold, each of which upon solidification throw off the absorbed gases. These liberated gases form a large number of holes, which in this case have united to make one large split between the inside and outside of the casting.

Casting Bronze Ring Around a Cast Iron Center

We have an order for some bronze rings 2 x 2 x 16 inches diameter to be cast around cast iron centers. This is a new departure for us and we shall appreciate your opinion on the proper procedure. Should the face of the cast iron be coated, and if so what is the best material.

No trouble will be experienced in pouring a bronze band around a cast iron center if the face of the iron is perfectly dry and perfectly clean. We assume that the cast iron face is machined and grooved to hold the bronze firmly in place. To insure a perfectly dry face the cast iron center is heated to approximately 200 degrees Fahr. before it is placed in the mold. If it is heated much above that point a slight scale will develop, practically invisible, but sufficient to repel the bronze and cause blowholes. The bronze is poured as soon as possible after the

cast iron center is placed in the mold. As a further precaution the bronze should be introduced through a tangential gate and a small amount run through a suitable riser. A light coating of chalk rubbed on the face of the iron will prevent the adhesion of moisture or the formation of incipient scale in the event that the mold is not poured almost immediately.

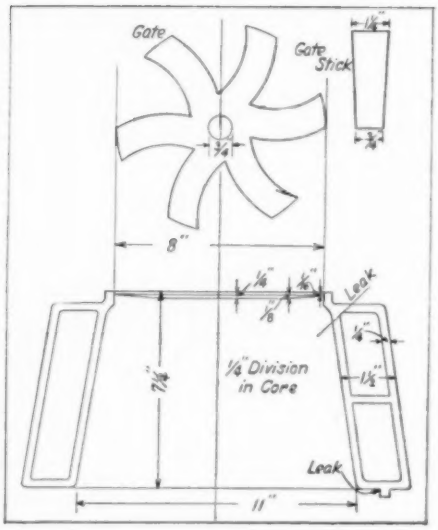
Sand Is Cut from Face of Water Jackets

The accompanying illustration shows our present method of gating a water jacket casting. This method is satisfactory on other types, but we are having trouble with the jacket shown. The only difference between this and the others is the bottom fit and the division in the core. A fine river sand in the mold cuts under the gate. We have tried a coarser sand but this cuts also. Clean sharp sand cores bonded with linseed oil are vented with 3/16-inch vent wax. We have tried a ring gate and have sprayed the green sand core with a weak core binder. We have tried bottom gating, but without success. The jackets look good but they leak and show a dirty streak under the gates.

Since the methods and materials serve satisfactorily on somewhat similar castings, we are inclined to the opinion that your trouble may be traced to the division in the core. Naturally, this feature interferes with the free and spontaneous escape of the core gas and some of this gas sets up a commotion in the metal instead of escaping quietly through the vent passages provided. This commotion will account for the rough area near the top in the vicinity of the gates and also undoubtedly will account for the leaking areas.

Before attempting any other changes, provide larger and more numerous vent passages in the core. Without doubt the leaking areas are due to gas from the core. The cut area under the gates may be due to the same cause, or, it may be due to the condition of the sand in the green sand core. The sand may be too wet or it may be rammed too hard. Therefore, it is advisable to check your sand condition carefully.

Branches of the gate cover nearly all the area over the top of the green sand core and thus all the steam generated has to pass down through the body of sand and out through the bottom of the drag. If this steam does not escape freely it will burst through the sand under the gates and produce the rough surface to which you refer. Use a dryer sand than usual in the green sand core and vent it with a large wire in the vicinity of the pattern for the first few experimental molds.



The partition or division in the core prevents the escape of gases

An alternative type of gate, superior in every respect to the one now in use, was described in the Nov. 1, 1931, issue of THE FOUNDRY, in the series of articles entitled "Prevent Losses with Proper Gates and Risers." Additional data on stove plate, hollow ware and sanitary casting gates appeared in the Sept. 1 and Oct. 1 issues of the same year.

Secures Whiteness With Nickel and Zinc

From time to time we receive orders for nickel silver castings, and it is not clear to us, if we are to expect best results from alloys high or low in zinc. It is not clear why high zinc alloys are in favor, unless it is to replace the copper with zinc and thereby reduce the cost. We believe we should expect less trouble from shrinkage with alloys of low zinc content. Will the percentage of zinc in the alloy have any effect on the color, as we have been told that alloys high in zinc will produce a whiter casting? What effect will the zinc content have, if any, in eliminating pits?

Nickel, or German silvers, as they were known before the war, vary widely in the proportions of copper, nickel and zinc contents. Partly because of the desire to match the color or some other part of the construction, and partly because of the method of manufacture used in production of the part. Much of the German silver is produced in the form of sheets by the rolling mills. This sheet is afterwards stamped into the different pieces desired. Due to the wide variety of alloys known as nickel silver, there is a considerable question as to which of the alloys is preferable; each manufacturer in accordance with his experience claiming his particular alloy as the most desirable.

You give no details as to the service requirements of your product. If it is to match in color some other part of the machinery—then a given alloy is desirable and the necessary method of producing the castings from that alloy must be worked out. If color is secondary and cheapness of manufacture is primary, then an alloy can be chosen which will give a whitish color and yet be a relatively easy material to cast in a sand mold. (We presume you are making your castings in sand molds.) While the bulk of the whiteness is imparted by the nickel content, an increase in zinc also tends to whiten the alloy. Therefore, where a given color is to be matched, an alloy containing the necessary amount of nickel and zinc to give the desired whiteness must be decided upon. That of course, may require considerable experimental work unless you have had considerable experience in making a variety of those alloys.

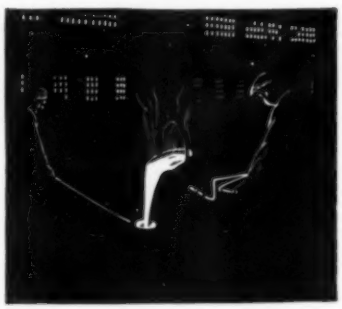
If the zinc content is increased, there is a slight tendency toward increase in shrinkage. This can be compensated for by proper gating an application of feeders to risers. Pitting of the surface generally is traceable to slow melting and consequent absorption of carbon by the nickel. To have best results in casting nickel silvers, it is desirable to melt rapidly in a furnace in which combustion is complete, so that there is a minimum of unburnt gases to be absorbed by a charge. Some producers of sand castings find the addition of 1/10 of 1 per cent of aluminum beneficial in reducing the zinc fumes and they claim such an alloy casts better in sand molds.

The low zinc nickel silvers generally are not quite as white as the higher zinc alloys and the higher the zinc content, the more fluid the metal is at a proper casting temperature. Any nickel silver requires care in melting, more so than in the case of bronzes and brasses. Soaking or holding in the furnace for an extended period of time is even more detrimental to nickel silver than it is to the high copper alloys. Therefore, it is important to melt rapidly, and as soon as the metal is at a pouring temperature, it should be removed from the furnace and cast at once. Hence, it is well to co-ordinate your melting and molding practices so that no delays are occasioned.

In molding German silver, the sand should be worked as dry as possible; gating should be worked out carefully and where shrinkage is to be expected, a riser should be provided that will feed that shrinkage. The melting point of the nickel silvers is somewhat higher than for brasses and, therefore, a harder core can be used. The core must be thoroughly vented to insure best results.

Viewing Foundry Developments

At Short Range



BEFORE removing risers from 4-6 per cent chrome steel castings with the cutting blowpipe, the entire casting should be brought to a good black heat, about 900 degrees Fahr., because the steel is more ductile at that temperature than at room temperature. Since 4-6 per cent chrome steel is air hardening above 1000 degrees Fahr., care must be exercised to keep the preheating below that temperature.

♦ ♦ ♦

Investigation at the Naval Research laboratory, Anacostia, D. C., indicates that metal contraction and hindered contraction resulting from mold or core resistance are mainly responsible for hot-tear cracks in steel castings. Cavities and physical properties of the steel also affect development of two types of hot-tear cracks: (a) Internal hot tear that develops during the solidification of castings and (b) external hot tear that develops after solidification is complete, but while the temperature is approximately 2372 degrees Fahr.

♦ ♦ ♦

A RECENT patent for heat-resistant cast iron involves the use of washed metal with additions of silicon, aluminum, chromium and vanadium. The preferred composition is 2.80 per cent carbon; 3 per cent each of aluminum, silicon and chromium and 0.17 per cent vanadium. The metal is said to resist scaling and warping at high temperatures, and applications cited are for glass molds, furnace equipment, valves for internal combustion engines, etc.

♦ ♦ ♦

A cylindrical core for use in casting cylindrical bodies, such as the cylinders of internal combustion engines, is made entirely of iron, steel, bronze or other metals, and is covered with a refractory coating, according to a recent British patent. The core may be hollow and its wall thickness varied to correspond with the chilling required. To insure adhesion of the coating, the core has external grooves or ribs and to allow the escape of gases the core may have passages and the coating have imbedded wick or other combustible material. The core may be cooled by forcing air or other fluids through its bore. If desired it may be built up of a number of pieces.

♦ ♦ ♦

THOSE familiar with static induced in sandblast operations are interested to learn of a hose adaptable to sandblast service that has been manufactured with a view to providing antistatic properties.

♦ ♦ ♦

What is claimed to be an innovation in blast furnace practice is the substitution of aluminum for the usual copper tuyere castings in a number of blast furnaces operated in Japan. Original experiments were commenced in 1923 following an investigation of the use of soft coke for fuel and the substitution of sea water for fresh water for cooling purposes. In a concluding 40-day test under identical conditions the total number of aluminum tuyere failures was 9 and for copper 29.

♦ ♦ ♦

A large glass manufacturer is chromium plating its gray iron glass molds to prevent sticking and to provide longer life.

♦ ♦ ♦

Molybdenum recently has been applied to the 15 per cent chromium stainless steels. Addition of 0.50 per cent molybdenum is said to increase the strength and wear resistance greatly.

♦ ♦ ♦

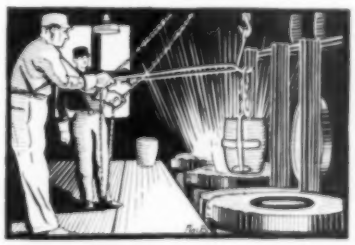
Man hole covers made from electric furnace gray iron in a midwest foundry show remarkable strength capable of resisting practically any weight that might be imposed upon them in the ordinary line of traffic. In a test, a tractor crane applied a weight of 15 tons while traveling backward and forward several times over one of these covers supported a few inches above the ground on two blocks under diametrically opposite edges. Design of the reinforcing ribs has been changed to effect a saving of 40 pounds, the difference between 212 pounds for the old type cover and 172 pounds for the new.

♦ ♦ ♦

CHROMIUM now is being added to cupola iron in amounts up to 25 per cent. In this type of iron it is desirable to keep the carbon as low as possible. This is done by using steel scrap in the charge. High chromium cast iron is used for wear and heat resistant castings.

♦ ♦ ♦

Application of the cast steel locomotive frame to the construction of railroad freight cars is a recent development. An all-welded hopper car having a one-piece, cast steel frame, has been constructed as a co-operative effort of the General Steel Castings Corp. and the Pullman Car & Mfg. Corp.



Lighter weight, a load carrying capacity of 70 tons, lower maintenance cost, resistance to corrosion and longer life are features claimed. The cast steel underframe weighs approximately 13,000 pounds.

♦ ♦ ♦

Addition of nickel to bronze causes the atoms to combine in a radically different manner than in ordinary bronze, according to a recent investigation. This results in increased strength. By controlling the size of these atomic groups through heat treatment, it has been shown that the hardness of the cast material may be doubled or tripled.

Men of Industry

Whose Activities Are Making Foundry History

F. A. JENSEN, for the past 3 years connected with the Russian government in the construction of foundries, has returned to this country and established a private practice as foundry consulting engineer with headquarters at 1868 Sheridan road, Evanston, Ill. Mr. Jensen spent 8 months in New York projecting two steel foundries and one carwheel foundry, and then was in Moscow, Russia, for 2 years and 4 months as consulting and projecting engineer.

EMIL G. SCHMIDT JR., formerly superintendent, Des Moines Foundry & Machine Co., Des Moines, Iowa, has been made foundry superintendent, Paxton-Mitchell Co., Omaha, Nebr.

LLOYD D. BRADY, formerly connected with the Ford Motor Co., Dearborn, Mich., and now with Andre Citroen Foundries, Paris, France, has changed his address to Royal hotel, 33 Avenue Friedland, Paris.

EVERETT D. BETTS, formerly connected with the Betts & Cole Heater Co., Marshall, Mich., has been placed in charge of manufacturing of the Ruddy Furnace Co., Dowagiac, Mich. The Betts & Cole company recently was dissolved.

HARRY WOLVERTON, who retired two years ago as superintendent of the Kalamazoo Stove Corp., Kalamazoo, Mich., after a number of years of service in that capacity, has rejoined that organization as superintendent of its new furnace plant. JACK ASPLAN is superintendent of the stove plant, another unit of the Kalamazoo company.

H. W. THORNE recently was elected president and treasurer, Holland Furnace Co., Holland, Mich., succeeding C. H. LANDWEHR. Other officers are as follows: Vice president in charge of production, P. T. CHEFF; vice president in charge of sales, P. W. BURNS; secretary, WILLIAM TAHANEY; and assistant secretary and treasurer, G. B. TINHOLT.

Accept Labor Provisions of Code

The code of fair competition filed by the Nonferrous Foundry Association for Industrial Recovery on Aug. 24 has been reviewed by the President's Recovery administration, according to Sam Tour, executive secretary, and the labor provisions have been accepted in substitution for the President's blanket agreement. Accordingly, those participating in the nonferrous code through membership in the association are entitled to modifications as follows:

For paragraph 2 of President's agreement—

"Employes (other than factory or machanical workers or artisans, outside salesmen and watchmen) shall not be employed for more than a 40 hour week averaged over a 4 weeks period; providing, however, that such employes shall not be employed for more than 48 hours in any week.

For paragraph 3 of President's agreement—

No factory or mechanical worker or artisan (other than technical workers now receiving $35.00 or more per week) shall be employed for more than a 40 hour week averaged over an 8 weeks period; providing further that such employes shall not be employed for more than 48 hours in any week, nor more than 6 days in any one week, nor more than 10 hours in any one day, and time worked over 8 hours per day shall be considered overtime, provided further that in the case of engineers, firemen, electricians and repair and maintenance crews a 10 per cent tolerance shall be allowed.

For paragraph 6 of the President's agreement—

No factory or mechanical worker or artisan in the North shall be paid less than 35 cents per hour for male employes and 30 cents per hour for female employes, nor less than 30 cents per hour in the South for both male and female employes. Learners and apprentices during one period of 60 days apprenticeship may be paid not less than 80 per cent of the minimum wage and shall not comprise more than 5 per cent of the total employes of each employer. Where female employes do substantially the same work and perform substantially the same duties as male employes, they shall be paid the same rate of pay as male employes are paid for doing such work or performing such duty.

This paragraph establishes a guaranteed minimum rate of pay regardless of whether the employe is compensated on the basis of a time rate or on piece work performance.

The South is hereby defined as comprising North Carolina, South Carolina, Georgia, Florida, Alabama, Tennessee, Arkansas, Mississippi, Louisiana, Oklahoma and Texas."

Approved Steel Code in Booklet Form

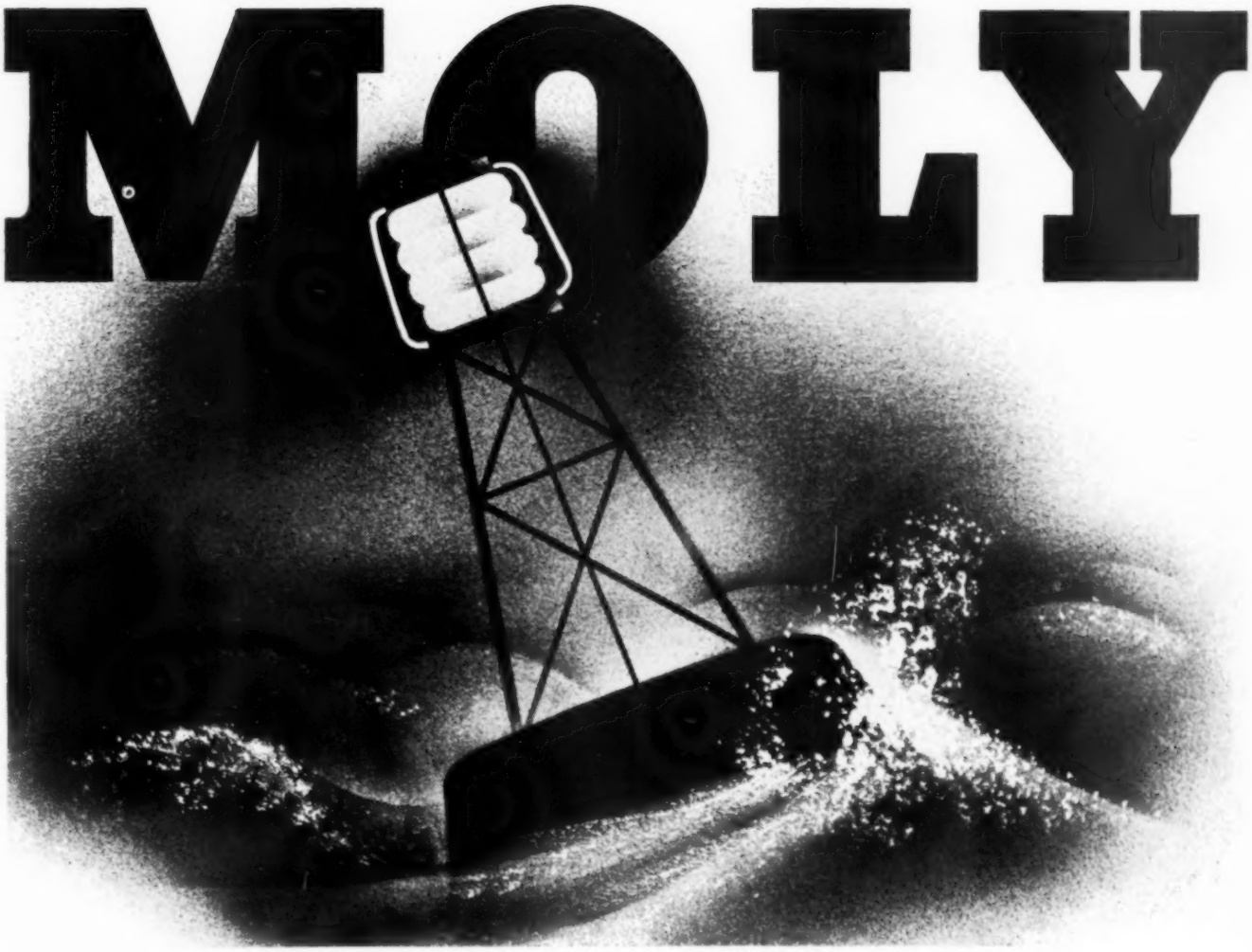
Code of Fair Competition for the Iron and Steel Industry, as approved by the President on Aug. 19, 1933, has been published in booklet form by the Penton Publishing Co., and may be secured through THE FOUNDRY, Cleveland, for 25 cents.

General Electric Moves New York Offices

General Electric Co. and four of its associated companies have announced the removal of offices in New York to the new General Electric building, 570 Lexington avenue at Fifty-first street. Included are the executive offices, New York district office, air conditioning department, electric refrigeration department, Atlantic division of the incandescent lamp department, merchandise department, and plastic department of the General Electric Co., and the General Electric Contracts Corp., G. E. Employes Securities Corp., General Electric Realty Corp., and International General Electric Co., Inc.

New York city headquarters were formerly at 120 Broadway, where for 15 years three complete floors were occupied. Approximately 50 per cent of the new building is occupied by the company.

MOLY



intensifies corrosion resistance in other alloys

MOLYBDENUM is unique in that small amounts of it intensify the desirable characteristics of other alloys. Thus it saves in total alloy costs! Furthermore, it improves many physical properties in iron and steel — always giving a better, and usually cheaper metal, for any definite application.

Take Copper Molybdenum ingot iron for example. It is the best known of all the corrosion resisting irons and steels, being extensively and successfully used to solve problems of atmospheric and mild liquid corrosion. This is because the Moly addition permits a greater copper percentage in solid solution in the iron. In the "18-8" stainless steels, 2½ to 4% Moly is being added to increase corrosion resistance. In boiler tubes and heat exchangers, Nickel Molybdenum steel has proved its unusual ability to resist corrosion.

Moly improves any iron or steel—at low cost. It increases machinability, tensile strength, creep strength and resistance to wear. The modern Climax laboratories in Detroit and the Climax metallurgists are prepared to show you how. Tell us your problems. Ask for details about our free engineering and experimental services and an important new booklet: "Molybdenum in Cast Iron." Climax Molybdenum Company, 295 Madison Avenue, New York City.

VISIT THE CLIMAX BOOTH—No. 49—AT THE NATIONAL METAL CONGRESS

CLIMAX Mo-lyb-den-um

Prevent Losses with

Proper Gates and Risers

By PAT DWYER

MANY factors contribute to the production of clean, solid aluminum castings. The number and combinations of these factors may vary to some extent in individual cases but one factor that never varies is the height of the pouring head, or perhaps more properly speaking the distance between the sprue or pouring basin and the lip of the ladle or crucible.

An article by Douglas B. Hobbs which appeared in the Sept. 1, 1929, issue of THE FOUNDRY, shows how a variation in the pouring height affected a set of experimental castings. The work was done at one of the plants of the Aluminum Co. of America. Opening statement in Mr. Hobbs' article confirms reference in a preceding number in this series to the effect that all exposed surfaces of aluminum whether solid or molten are covered with a layer of aluminum oxide. This enveloping film acts as a protective coating against further oxidation. If it is broken the freshly exposed surfaces become oxidized immediately.

In view of the foregoing, molten aluminum should be handled as quietly as possible. The resulting oxidation will be in direct ratio to the violence or extent of the agitation to which the metal is subjected. This feature is applicable, not only to pouring castings but wherever liquid aluminum is handled in alloying, pigging, remelting or casting.

To secure castings free from dross inclusions the metal should enter the mold without excessive agitation or splashing. As with other metals the open sand mold offers a convenient medium for watching the behavior of aluminum. While this work usually is entrusted to unskilled help, molders, foremen and others directly responsible for the production of clean castings, can learn valuable lessons by closely watching the behavior of molten aluminum in filling pig molds. A pig or ingot is the simplest form of casting presenting practically none of the hazardous features found in other castings. Still, a noticeable difference will be found between a pig poured under proper precautions and one in which these precautions are ignored.

The ingot mold should be held as close as possible to the tapping spout, or, if the metal is poured from a ladle or crucible, the lip should be placed close to the mold. The stream of metal should not be broken at any time during the pouring operation.

Amount of oxidized material on the unskimmed surfaces of two 30-pound ingots of the following composition: Copper 7.00 per cent, zinc 2.00 per cent, iron 1.25 per cent, aluminum 89.75 per cent, amounted to 0.21 per cent where the metal was poured from a crucible lip in contact with the mold. Ingots poured according to the second method yielded 0.67 per cent.

More important perhaps than the loss caused by pouring the metal from an appreciable height, is the fact that some of the oxidized material may remain in suspension in the ingot and eventually find its way into a casting. A sound casting must be free from dross inclusions, air pockets or other defects. The amount of dross may be minimized by gating the casting in a manner to permit the metal to enter the mold quietly and one of the most important features in this connection is to pour the metal from a minimum height.

In many instances the sprue is so located, or the casting is poured from such a large ladle or crucible that the lip must be held from 6 inches to 2 feet above the sprue. Variables of this kind naturally affect the quality of the castings. The pouring basin or sprue should be adjusted to eliminate this condition.

A certain type of cavity is caused by air sucked in through the sprue with the metal. Some of the air may escape, but a certain amount will remain trapped by the solidifying metal. Entrance of air may be prevented to a certain extent by the type of gate adopted, but a better method is to pour the metal from a minimum height and thus eliminate the hazard.

Generation of steam and other mold gases constitute another hazard, but this also may be held to a minimum by the arrangement of the gates and risers and by the use of a molding sand adequately permeable for the purpose. Naturally this latter feature will vary on different classes of castings. The quality of a casting depends mainly upon two factors, the manner in which it is gated and the manner in which it is poured.

However, a low pouring head in itself is not a positive guarantee of a perfect casting. Better results may be obtained with a comparatively high head and perfect gates, than with a low head and gates that do not function properly. Occasions arise when a comparatively high head is necessary to impart sufficient velocity to the metal to fill the mold. Wherever possible, it is preferable to change the gates and keep the pouring head low.

Control of pouring height is important with either low or high pouring temperature. An increased tendency toward oxidation is present where castings are poured at high temperatures. Pouring the metal from a minimum height will aid in decreasing the amount of oxidation. Metal poured at comparatively low temperatures is more viscous and sets more quickly. The faster the rate of solidification, the less chance for trapped gas to escape. The speed of solidification also affects the grain size.

Improved physical properties will

(*Continued on page* 32)

Advise Low Head

THE surface of molten aluminum is covered by a thin film of oxidized metal. When this film is broken through agitation of the metal, intermittent pouring or any other cause, a new film forms immediately. Each time the film is broken a certain amount of oxidized material becomes detached and floats into the casting, to reappear later as dross, either on the surface of the casting or as an inclusion in the interior. For the foregoing reason one of the primary requisites in the production of sound castings, is to pour the metal in a manner that will insure a quiet and steady entrance to the mold cavity. Manifestly metal from the lip of a ladle or crucible held close to the sprue will enter the mold more quietly than metal falling from a lip held high above the sprue or pouring basin.

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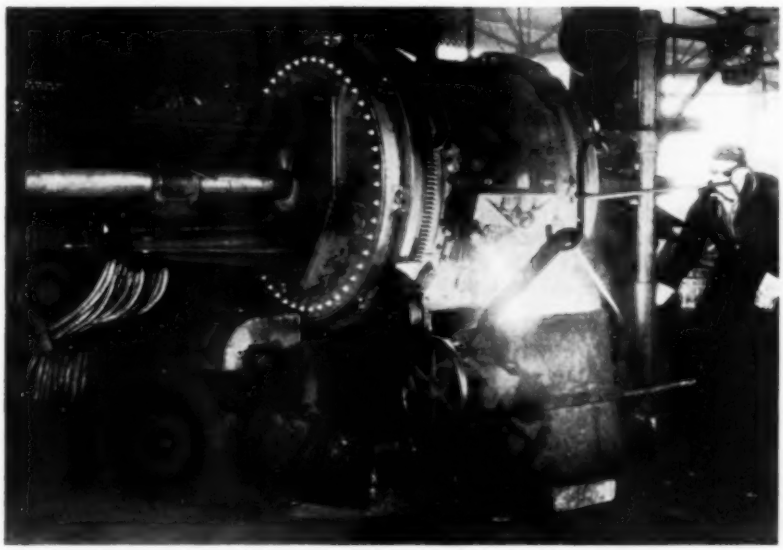
CASTINGS TO PRECISE SPECIFICATIONS



Such Castings can be Produced in YOUR FOUNDRY Most Readily and Most Profitably By Using a

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For over fifteen years DETROIT ROCKING ELECTRIC Metal Melting Furnaces have been in use in foundries where precise control of analysis, thorough mixture of alloys and accurate control of temperature is essential. Their economy in operation and assurance of quality product is an outstanding characteristic. May we show you not only what other foundries are doing, but *what you may do in your foundry* with these MODERN MELTING MACHINES.

DETROIT ELECTRIC FURNACE CO.

825 W. Elizabeth St., DETROIT

(*Continued from Page* 30)

follow low pouring temperatures and for this reason it is advisable to pour the metal at as low a temperature as is consistent with safety.

Effect of pouring height on the soundness of castings gated according to different methods and poured at different temperatures was noted in slabs ¼ x 6 x 12 inches cast from the alloy referred to previously.

Three types of gates shown at *A*, *B* and *C* in Fig. 215 were used in conducting these experiments. All the gates were the same thickness as the castings with the single exception of the gate shown at *C*, where the gate was choked close to the casting.

Some of these castings were poured from a hand ladle held 1-inch above the top of the sprue, while the metal was poured into others from a height of 12 inches above the top of the sprue. With a 5-inch cope this meant that the metal dropped through heights varying from 6 to 17 inches. With the exception of one of the slabs shown at *C*, the sprue in all instances was kept filled throughout the entire pouring operation. In the exception noted the metal was poured so slowly that the sprue was not filled until the close of the operation. Investigation was conducted on pouring temperatures of 1250, 1400 and 1500 degrees Fahr.

Since risers in some instances tend to mitigate the extent of dross inclusions and air pockets, defects usually traceable to improper pouring heights, no riser of any kind was placed on the molds used in this series of experiments.

In castings gated at the side and at the end, no choke was used in the gate, but the sprues were kept filled. One casting in each instance was poured from a height of 1 inch above the sprue. A second casting was poured from a height of 12 inches. Metal in all instances was at a temperature of 1250 degrees Fahr. In every instance and irrespective of the type of gate, the casting poured under a low head was the sounder of the two.

A comparison of the castings poured under a high head shows that the casting poured through a single gate was the worst and the slab poured through a double branch gate was the best. Among the castings poured under a low head, the slab poured through a double gate at one end was the best while that poured through four branch gates at one side was least satisfactory.

With the latter type of gate the metal entered the mold at four points. The mold was filled quickly and the tendency to hold trapped air in the metal was pronounced. Agitation was set up by the distance the metal had to travel in the runner and the right angle turn it had to make before entering the mold.

Slabs gated through a double branch at the end allowed the metal to enter the mold quietly and directly at two points. The mold was not filled as quickly as in the former instance. Therefore any mold gases had a chance to escape. No trace of trapped gas was found in the slab poured under a low head. Unsoundness shown in the second slab in the same test was due to agitation of the metal and to air sucked in through a high sprue.

Under a low head the type of gate shown at *A*, Fig. 215, will serve satisfactorily. Little if any chance exists for mold gases to become trapped, but there is a marked tendency for the metal to become agitated due to the swirling action. Violence of this swirling action increases with the height

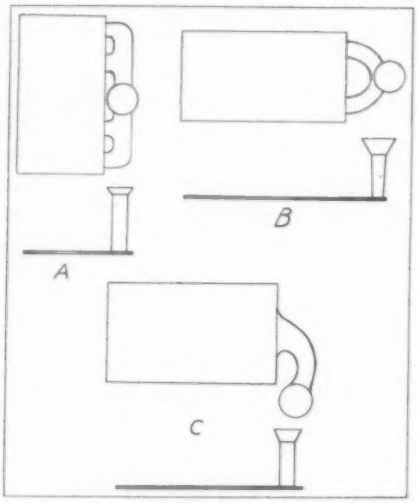

Fig. 215—For purpose of comparison the duplicate pairs of castings were gated according to the three methods shown at A, B and C

of the head. Thus castings gated in this manner and poured from a height of 12 inches were the worst in the group. Under low pouring heads little difference was shown between castings gated in this way and castings gated as in *B*, same illustration.

The only variable changed on a second series of slab castings was the pouring temperature. These castings were gated and poured in the same manner as those previously described, but at a temperature of 1400 degrees Fahr. Considering only trapped gases, these slabs were sounder than slabs poured at 1250 degrees Fahr. The metal was more fluid and remained in that state for a longer period, thus providing the mold gases and the air sucked in through the sprue a better chance to escape. A pouring temperature of 1500 degrees Fahr. was even better in this instance as shown by the slab poured at that temperature.

An increase in the pouring temperature involves a corresponding increase in the grain of the metal in the casting and a greater tendency toward shrinkage and draws as shown by Bossert, *Transactions*, American Foundrymen's association, 1928. This tendency is apparent in the x-ray negatives of castings poured at the higher temperatures. While more or less of the trapped air may be liberated, the physical properties of the castings are decreased due to the increased grain size and the tendency toward shrinks and draws. As the pouring temperature is raised, the chances for oxidation are increased. An examination of slabs poured at high temperature shows that the principal defect outside shrinks and draws is dross.

Comparison of the experimental slabs with respect to gating, indicates that only slight differences exist in castings poured under a low head. Possibly the slab gated through a double branch at one end is a little better than the other two. The trifling difference in the appearance of these slabs clearly showed that mold gases escape more readily at the higher pouring temperatures.

In the group of slabs poured from a height of 12 inches, the slab gated as at *C*, Fig. 215, was the worst and the casting gated as at *B* was the best. Castings poured at a temperature of 1250 degrees Fahr. showed the same difference with respect to gating. This confirms the claim that under a high pouring head the principal defects are due to agitation and to air sucked in with the metal.

In one complete group of castings the gates were the same thickness as the casting. To partially overcome the detrimental effects of a high head, the thickness of the gates at the point of contact with the casting then was reduced to 1/16-inch. The metal was poured from a height of 12 inches and at a temperature of 1250 degrees Fahr. The sprues were kept filled. Results of the experiment seemed to indicate that the deleterious effect of high pouring is overcome to some extent by choking the runners, irrespective of whether the castings are gated as at *A*, *B* or *C*, Fig. 215. However, while the effect of pouring from an appreciable height may be neutralized to some extent by choking the runners, the practice is not recommended. A low pouring head with resulting elimination of one form of hazard is preferable.

In pouring all the castings thus far described, the sprue was kept filled throughout the entire operation. That this practice should be followed at all times was demonstrated clearly when one of six pairs of castings was gated as at *A*, Fig. 215, and poured so slowly that the sprue was not filled. The second casting of the pair was gated in the same manner and poured at a speed which kept the sprue filled. Both castings were poured from a height of 12 inches and at a temperature of 1250 degrees.

The results clearly showed the advantages of keeping the sprue filled. The effect is magnified at the higher pouring heights, since there is a greater tendency for agitation and for sucking air into the sprue, but it holds at

(*Concluded on Page* 35)

ADVERTISING PAGES REMOVED

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all pouring heights. Merely choking the sprue does not necessarily insure a good casting, but choking the sprue improves the quality of the casting and should be adopted as standard practice in pouring aluminum and aluminum alloys.

The following general conclusions may be drawn from the foregoing description of a series of interesting experiments: To secure the best results, aluminum or aluminum alloys should be poured under the lowest practical head, regardless of the manner in which the castings are gated. Metal poured from an excessive height becomes agitated and produces dross inclusions in the casting. Air is sucked in with metal poured from an appreciable height and may become trapped in the casting. Unless the casting is gated properly it may be defective even where the metal is poured from a ladle or crucible held close to the sprue. To some extent pouring height is related to temperature, but as a general rule, a low pouring head is best.

This is the forty-fourth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The forty-fifth instalment will appear in an early issue.—THE EDITORS.

Numerous Methods Available For Inciting Good Truck Driving

A PROGRAM for driver training and control that does not include means for stimulating maintained interest and effort toward greater safety, efficiency and courtesy is complete. There are two classes of stimulants—rewards for good performance and penalties for poor performance. Few omit penalties but many consider those enough and provide no rewards. The majority however have both. That alone would commend it as the best practice for it shows that experience confirms the theory that the more incentives the greater the effort.

There are various ways in which this is done. In general they would all fall within four classes: Bonuses or prizes; salary review or wage increases at given periods; medals or certificates; vacation with pay.

One of the most common incentives is a cash bonus or prize, either money or something of value, awarded at certain intervals. It may be given for safety alone, that is, awarded for a certain accident-free period, or it may depend upon or be augmented by other clear records, such as, no idle time, no complaints from customers or, if the drivers are salesmen as well, a certain volume of sales.

A large New York company, after using the bonus system, abandoned it in favor the salary review and found that a definite improvement was noticeable. Every 6 months each driver's salary is reviewed, particularly with reference to his safety record although not entirely so. If he has had a clean record for 8 months he is entitled to an increase. If for only 6 months the increase is authorized two months ahead, provided the driver's record continues clean. The advantage this company finds in the salary review is that the driver is thinking in terms of his permanent status of income rather than the occasional aspect of a bonus, for he is continuously striving to increase his earning power.

To some drivers, and there are those who think they are the better type, pride of achievement is as gratifying as money in the pocket and to such the prospect of a medal or certificate is fully as stimulating as hope of winning a bonus or money prize.

Vacation with pay is merely another form of reward most similar in principle to a bonus and usually given for fulfilling the same requirements. Men appreciate time off, whether it is a day or week or more. It gives them time to attend to personal affairs or indulge in recreation and makes for satisfied employes, well worth in its advantage to the employer whatever it may cost for it usually makes the drivers better fit both mentally and physically.

Whatever has been said of the unbalance of a system that had only penalties would apply if it had only rewards. Indeed such a system would be even more lopsided, and if there are any such they are extremely few. So, it may be said without qualification that every driver training and control program should provide punishment for poor performance. Penalties likewise would all come within four classes: Fines or suspensions; loss of vacation; loss of seniority; dismissal. They are one and the same thing in effect and are meted out for the same causes differing only in degree according to the seriousness of the offense.

It may seem that enough has been said in the earlier articles about the importance of keeping drivers' records. This discussion of rewards and penalties must have made their necessity obvious.

William H. Moore recently has been appointed Chicago district manager of the Peninsular Grinding Wheel Co., Detroit. Mr. Moore previously was connected with several railroads, the Metal & Thermit Corp. and the Burnside Steel Foundry Co.

Book Review

Industrial Purchasing, by Howard T. Lewis, cloth, 536 pages 6 x 9 inches, published by Prentice-Hall Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

This book is a publication of the National Association of Purchasing Agents, and may be considered as an official guide to the subject of purchasing. In the preparation of the work, the author enjoyed the close co-operation of the association and it is pointed out that every chapter has been read and revised by several specialists on each of the respective subjects under discussion.

The author first discusses the significance of the function of purchasing in the rehabilitation of business which is under way. He also points to the relation of various phases of business such as production, inspection, traffic, marketing, etc. The problem of centralization of purchases is discussed and the arguments for and against listed. This is followed by a study of purchasing procedure.

Quality of purchases is an important consideration and therefore the text points to the factors which must be considered by the buyer. This is followed by information on inspection and its place in the organization; control and quantity of stores; sources and assurance of supply; price policies; speculative purchasing; purchasing budgets; purchase of installations; purchasing and its relation to marketing; measurement of purchasing efficiency; and some legal aspects of purchasing. The book also contains a bibliography of published material on the subject of purchasing.

Acquire New Division

Lumber Bi-Products, Inc., 702 M. & T. building, Buffalo, recently has established a wood flour division through the purchase of assets of the former New England mills at Manchester, N. H. Wood flour is finely pulverized wood which is refined into several grades and used as a core flour and as a filler in numerous formulas. M. J. Watson is president of the company.

Gives Railroad Data

Committee on Public Relations of the Eastern Railroads recently has published the 1933 edition of "A Yearbook of Railroad Information." The booklet, giving information on value, capitalization, mileage, equipment, operating rates, revenue, traffic, earnings, employes, wages, and service, may be secured through the committee, 143 Liberty street, New York.

Ladles and Pouring Efficiency

Correct capacity reduces overmelt, provides lowest cost for pouring and decreases losses

By ALBERT J. SAUTE

IN ESTIMATING the cost for new work or giving new estimates on jobs previously made in the shop, no special thought usually is given to size or capacity of the ladle used in pouring. Credit for the pouring operation either will be a set rate per 100 pounds of metal poured or merely will be guess work on the approximate worth of pouring the jobs. The estimator takes it for granted that the regular shop ladles will be used—and they are used. This is especially true for production shops or shops that have a regular line of castings.

Many time-studies were made in setting up a piece price system for the class of work that must be poured from single hand ladles. The piece price system being installed was on a time allowance basis for each element performed by the operator. The shop had the piece price billing method in operation so that each casting required an individual price for pouring, either by molders or special pourers.

A liberal percentage allowance was given for the fatigue factor of the pourer. Time between actual pouring periods was spent in shifting weights, clamps or jackets; or merely just waiting for metal at the pouring or ladle stations. All pouring stations were situated approximately the same distance from the floors poured in all time studies. In computing the time studies the average waiting time (time between pouring periods) per mold was added to the average pouring time per mold, plus the fatigue factor, the results being the credits for the pouring operation. The castings poured were the general line of electrical machine type having a head and gate ration of approximately 30 per cent. Single hand ladles used had a capacity of about 60 pounds of molten metal.

Time studies then were compiled and charted on graph paper, using the ordinate as the credit in time allowances and the abscissa as the total weight of cleaned casting or castings per mold poured as shown in the accompanying illustration.

The curve shows a lower time allowance value in the low weight range than in the heavier castings because a greater number of molds can be poured with only one trip to the pouring station. The heavier castings require one trip to the pouring station for each mold poured. In pouring larger casting (35 to 50 pounds) whatever iron was left in the ladle after pouring the mold, either was dumped into the pig bed or carried back to the pouring station for additional hot metal. In doing this the fatigue factor of the pourer was increased greatly.

A further analysis of the plotted curve shows that the highest point occurred when the weights of the cleaned castings poured were between 25 and 35 pounds. The cause of this high point in the curve is due to the relation that exists between weights of cleaned castings poured and capacity of the pouring ladle. In pouring a cleaned casting of 25 pounds it required approximately 33 to 35 pounds of metal; therefore, when the first casting was poured the workman examined the remaining metal in his ladle and debated as to whether to take a chance to pour another one or to play safe and pig the remaining 20 pounds or so. Unless there is a mixture of different weights of castings on the floor to pour, the pourer will bring a superfluous amount of metal each trip from the pouring station and evntually the pig beds will be full. If the pourer thought he could squeeze in enough metal for two molds he would decrease the factor of safety and would work in such an unsafe way as to cause a hazard to the safety of others and himself in the shop, besides frequently pouring some castings short.

Should the range of work for long runs be in between 25 and 35 pounds it would be advantageous to the management to increase the ladle capacity to take care of pouring two castings—or better still, decrease the ladle's capacity to pour one casting with the regular safety percentage for runouts, fins, etc. In that case the pourer would make a light easy trip to the pouring station without much fatigue.

More studies were made in another department where capacity of the ladle or pot used was approximately 37 pounds. The same curve form was obtained, but the high point was between 16 and 22 pounds. This theory will hold true in mechanical pouring

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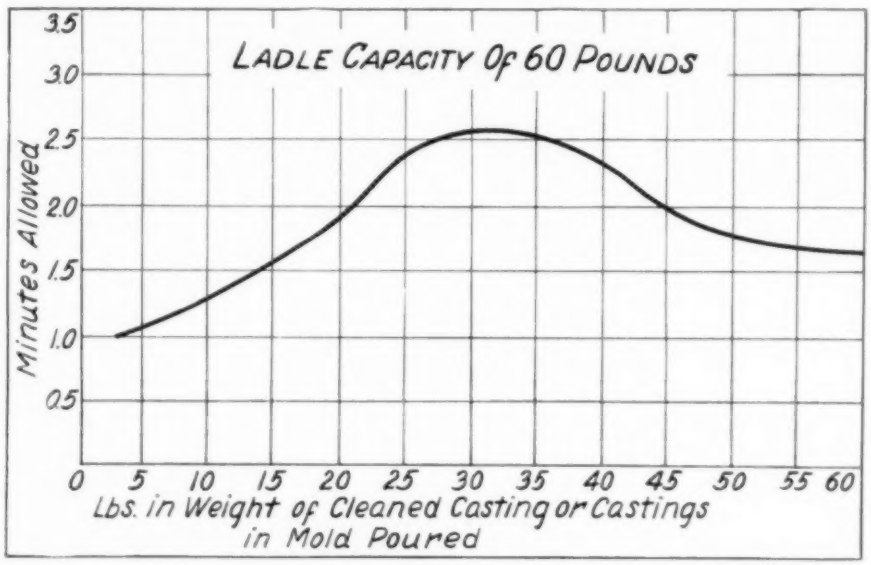

Curve shows different time allowance values in the different weight ranges

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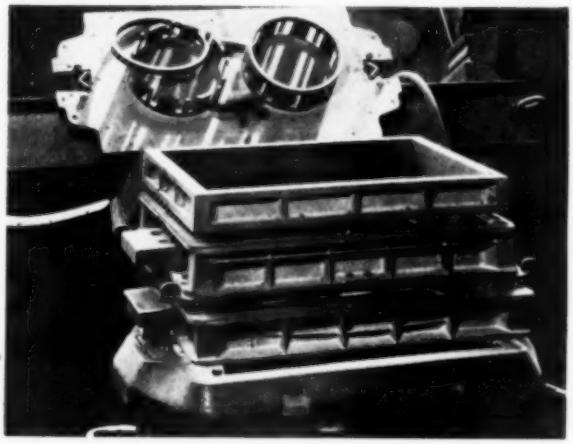

Cope and Drag Match plate for 3 part flask

Original pattern equipment furnished by the customer. Cope & drag match plate with loose rings, pattern made for 3 part or 3 section flask.

When equipment of this type is used it makes it necessary to have a number of various sized 3 part flasks, to fit the different size patterns in order to handle this type pattern equipment.

Match Plate made during show from a number of small loose patterns. Time required one hour and a half. Total cost less than $3 for material and labor.

Original Pattern Equipment + TAMASTONE and Parting Frame *Production Increased Over 100%*

The same Pattern Equipped for 2 part flask thru the use of TAMASTONE.

1. Made parting frame of wood.
2. Mount loose rings in Tamastone by using wooden frame to get parting line and alignment.

MOLDING INSTRUCTIONS FOR THIS JOB

1. Ram up drag from Tamastone match plate.
2. Make cheek using wood parting frame. Remove wooden frame close drag over cheek roll over and ram cope, remove cope draw match plate and close the mold.

Same Pattern Equipment + Tamastone and Parting Frame

We request the privilege of furnishing you with a sample of "Tamastone" and have our Representative demonstrate its efficiency on your own work and with your own patterns.

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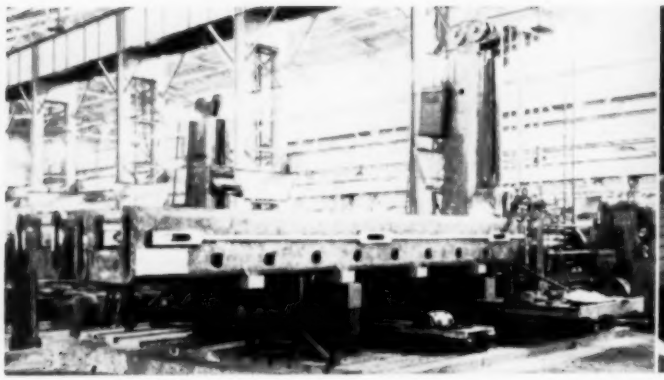

Fig. 1 (Left)—Each column section is 25 feet long and 28 inches wide. Fig. 2 (Right)—A steel casting for the lower cross head as it appeared on the floor of the erection shop

Many Castings Are Used

In Largest Testing Machine

WHAT is claimed to be the largest machine in the world designed for the scientific testing of the strength of materials, recently was completed at the shops of the Baldwin-Southwark Corp., Philadelphia, and shipped to its ultimate destination the University of California, Berkeley, Calif. This machine can test columns 33 feet 6 inches in length with a compression load up to 4,000,000 pounds. In tension the load may be applied up to 3,000,000 pounds. Other features include a total height of 46 feet 9 inches above and 25 feet below the floor line. Total weight on the foundations is approximately 475,000 pounds.

Compression tests are carried out between the lower crosshead and the table. Tension tests are made between the upper crosshead and the yoke around the lower crosshead. The total stroke of the lower crosshead is 48 inches—ample for the extension of practically any tension specimen to be tried on this machine. The change in adjustment for specimens of different lengths—up to a maximum of 33 feet 6 inches—is effected by two vanadium steel screws 12 inches diameter and 56 feet 8 inches in length working in long bronze nuts in the lower crosshead. The motor for operating these long screws is controlled from a glass enclosed room where an operator at a central control board is in telephone communication with the operator of the machine. Provision is made for operating loud speakers in the event that a number of men wish to be informed of the progress of any given test.

The greater part of the machine is made up of steel castings. The side screws are forged steel. The nuts are bronze and the hydraulic rams are cast iron. The weight of the main ram, 46 inches in diameter, is 28,000 pounds and the weight of the cast steel cylinder is 40,000 pounds. The grips for tension testing are chrome nickel steel, heat treated and machine cut. They weigh more than 3000 pounds and occupy recesses in the cast steel crossheads about 12 x 24 inches. The cast steel table to which the main cylinder ram is fixed and on which the cast steel columns rest is 6 feet 6 inches x 17 feet 3 inches. It is 35 inches in depth and weighs 50,000 pounds.

In the accompanying illustrations Fig. 1 shows a pair of column sections undergoing an operation in the machine shop. Each casting is 25 feet in length, 28 inches wide, 36 inches deep and weighs 26,775 pounds. Two sections, one mounted on top of the other were required for each column of the completed machine.

The steel casting for the lower crosshead is shown in Fig. 2. This casting is 9 feet in length, 7 feet 6 inches wide, 4 feet 6 inches deep and weighs 37,000 pounds. The upper crosshead is shown in Fig. 3. It is 13 feet 6 inches in length, 7

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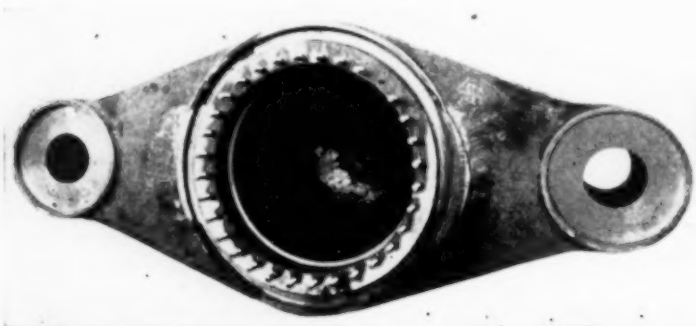

Fig. 3 (Left)—The upper cross head is 13½ feet long. Fig. 4 (Right)—This casting weighs 43,340 pounds

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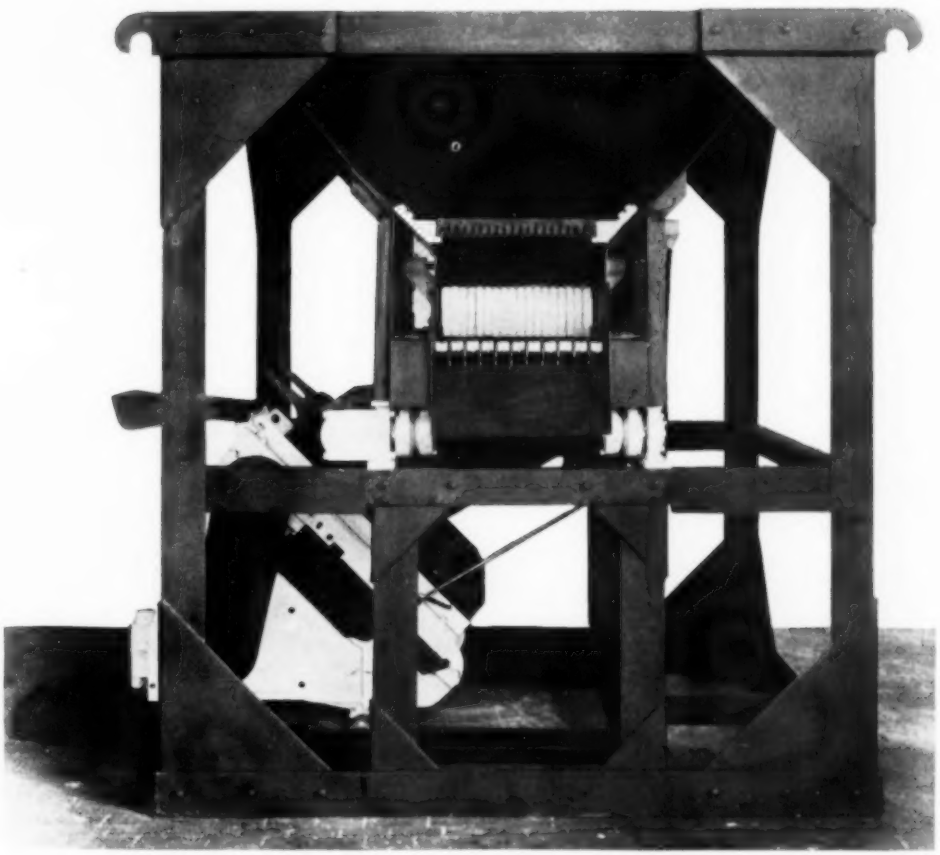

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(*Concluded from Page* 38)

feet deep, 5 feet 8 inches wide and weighs 43,340 pounds. The fourth casting in the group Fig. 4 is 13 feet in length, 5 feet 8 inches wide, 3 feet 6 inches deep and weighs 41,200 pounds. All the castings were made at the plant of the Standard Steel Works Co., Burnham, Pa.

Ladles and Pouring Efficiency

(*Concluded from Page* 36)

devices or monorail ladles where the weight of the cleaned casting poured is a small multiple of the pouring ladle's capacity. For example if a cleaned casting weighs 50 pounds and the capacity of the pouring devices ladle is 200 pounds then it will only be possible to pour three molds at each loading or the capacity of the pouring ladle will have to be increased to such an extent to take care of pouring four molds efficiently.

On large work that is being made regularly in the shop and is poured with large crane ladles, a series of wrought iron gages (a handle of sufficient length with a 90 degree leg of correct length) can easily be made by the pouring foreman. These gages can be kept near the cupola and used when the crane ladles are being filled.

Therefore when a worthwhile order of the same line of castings comes into the shop to be made, a ladle of the correct capacity should be assigned to the pourer to obtain the greatest pouring efficiency, the least foundry overmelt, the lowest cost for the pouring operation and a higher percentage of good castings.

Four Foundry Codes Are Filed

(*Concluded from Page* 15)

appreciate the need for united action. Steps have been taken to acquaint all such foundries with their need under the N.I.R.A. in participating in some way under an industry code.

A similar condition in some measure has been encountered in the nonferrous foundry industry where the Nonferrous Foundry Association for Industrial Recovery has within two months set up an organization, compiled a code, referred it to group meetings for discussion and acceptance and has filed its code at Washington. Here again the apparent apathy of many smaller organizations has presented a distinct problem. Nevertheless, a nucleus of fair size as to numbers and of broad representation as to capacity has taken the initiative and provided the means whereby all nonferrous foundries may find participation possible under the N.I.R.A.

Book Review

Enough for Everybody, by Albert M. Newman, cloth, 186 pages, 5 x 8 inches, published by the Bobbs-Merrill Co., and supplied by THE FOUNDRY, Cleveland, for $1.25 and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

Changes in economic conditions, wrought by the machine, in the opinion of the author, have substituted goods values for capital or labor value and so removed the reason for class struggle inherent in those values. The new plenty has given to the consumer a new importance and made necessary consideration of his welfare. This suggests that goods should be produced with use instead of sale the prime object of production. Production for use implies planned production under a centralized control.

The author points out that present practice and economic trend are toward centralized control whether through government ownership, cooperative enterprise or the merging of private companies into large corporations. The separation of government and business is a practical impossibility, in his opinion, and present attempts to effect an artificial division are responsible for the irresponsibility of government and the misconduct of business.

Planned economy should bring numerous advantages, including the abolition of war insofar as it is traceable to economic rivalry, a great decrease in crime, a check in the waste of natural resources, a housing supply adequate for all, and beautiful and comfortable communities combining the advantages of town and country.

Pump Handles Liquids at High Heads

Roots-Connersville-Wilbraham, Connersville, Ind., recently has introduced a new line of turbine pumps suitable for handling liquids at high heads. Capacities range from 5 to 300 gallons per minute at heads up to 350 feet. A feature of the pump is a taper-edge impeller, providing the means of varying the quantity while the pump is running. There is a slight increase in capacity as the head falls, with a noticeable decrease in power consumption. The taper-edge impeller may be adjusted to give volume required at lower heads while taking full advantage of savings in power consumed.

Suction and discharge openings are located in the main pump housing, thus facilitating disassembly for cleaning. Pumps are supplied in corrosion resisting metals or alloys, thus adapting them for service in many difficult industrial applications.

George H. Corliss has been appointed sales promotion and advertising manager for Lewis-Shepard Co., Boston, manufacturer of transportation equipment. Mr. Corliss for the past three years has been connected with J. A. Fay & Egan Co., Cincinnati and Kewaunee Mfg. Co., Kewaunee, Wis. Previous to that time he was connected with the S. A. Woods Machine Co., Boston.

Harnischfeger Corp., Milwaukee, has an attractive display in the Travel and Transport building at the Chicago Fair, illustrating its line of hoists, cranes and welding equipment

Steel Founders' Code

ADVERTISING PAGES REMOVED

(*Concluded from Page* 14)

classification, formed in accordance with the provisions of Sect. 1 of this Article, so decides, each member of the industry manufacturing products falling within such subdivision or product classification shall within 10 days after notice of such determination, file with the agency a price list prepared by such member of the industry, showing its current prices and the agency shall immediately send copies thereof to all members of the industry engaged in the manufacture of such specified product. Revised price list may be filed from time to time thereafter with the agency by any such member of the industry to become effective upon the date specified therein, but such revised price list shall be filed with the agency at least 10 days in advance of the effective date, unless the agency shall authorize a shorter period. Copies of such revised price lists with notice of the effective date specified shall be immediately sent to all members of the industry manufacturing such product who thereupon may file, if they so desire, revisions of their price lists which shall become effective upon the date when the revised price list first filed shall go into effect.

If the agency of any subdivision or product classification so decides, no member of the industry within such subdivision or product classification shall sell directly or indirectly by any means whatsoever any product of the industry included within a subdivision or product classification for which the agency shall have given notice requiring the filing of price lists, at a price less than the price shown for such product in the list filed by such member.

Sect. 3—It is the consensus of opinion in the industry that until such time as the demand for its products cannot adequately be met by the fullest possible use of existing steel foundry melting capacity, such capacity should not be increased. Accordingly, except with the approval of a three-fourths vote of the board of directors, none of the members of the industry shall initiate any increase in such capacity; provided, however, that nothing herein contained shall be construed to forbid substitution of one melting process for another, if such substitution shall not result in substantially increased capacity for production.

Article VIII—Amendments

Amendments to this code, if approved by the agency of the subdivision or product classification concerned, if any, and by the board of directors, shall be submitted to the President, and if approved by the President, shall become effective 10 days thereafter.

Article IX—Cancellation or Modification

The members of the industry recognize that pursuant to subsection (b) of Sect. 10 of the National Industrial Recovery act, the President may from time to time cancel or modify any order, approval, license, rule or regulation issued under Title I of said act with respect to this code.

Article X—Violations

Violation of any of the provisions of this code, or amendments thereto, is an unfair trade practice and shall be subject to the penalties provided in the National Industrial Recovery act.

Article XI—Duration

Any participant in this Code may withdraw from it participation therein at any time after Title I of the National Industrial Recovery Act has ceased to be in effect. Subject, however, to its then accrued liability as a participant.

Article XII—Unfair Trade Practices

Sect. 1—With respect to the production and/or sale of miscellaneous castings, the unfair trade practices which are condemned are set forth in Schedule D, annexed hereto. Such unfair trade practices shall have no application to that part of the industry engaged in the production and/or sale of specialties.

Sect. 2—With respect to the production and/or sale of specialties, the unfair trade practices which are condemned, are set forth in Schedule E. Such unfair trade practices shall have no application to that part of the industry engaged in the production and/or sale of miscellaneous castings.

Sect. 3—Indulgence in any of the Unfair Trade Practices, or any amendments thereof, or any additions thereto, shall be deemed to be unfair methods of competition, and using or employing any of such unfair methods of competition shall be deemed a violation of the Code, and any member of the Industry which shall directly or indirectly, through any officer, employe, agent or representative, use or employ any of such unfair methods of competition shall be guilty of a violation of the Code.

Schedule B

Description of Wage Districts

1-A. Eastern District—All of Division No. 1

Note: Division No. 1 constitutes Federal Reserve district No. 1 and No. 3 (except that part of Pennsylvania west of a line drawn north and south through Altoona, Pennsylvania) and No. 5 (except West Virginia and North and South Carolina) and New York State east of a line drawn north and south through the most westerly point of Schenectady, New York.

2-A. Buffalo District—All of Division No. 2

Note: Division No. 2 constitutes Federal Reserve district No. 2 (except that portion included in Division No. 1) and Erie, Pennsylvania.

3-A. Southern District—All of Division No. 3

Note: Division No. 3 constitutes Federal Reserve district No. 6 and No. 11 (except southeastern Arizona, southern New Mexico, and Texas west of a line drawn north and south through Haymond, Texas) and all of North and South Carolina, Tennessee, Mississippi and Alabama (except Jefferson county).

3-B. Birmingham District—County of Jefferson in the State of Alabama.

4-A. Johnstown District—Cambria county, Pennsylvania.

4-B. Pittsburgh-Wheeling District—All of Pennsylvania in Division No. 4 (except Cambria County) and the Counties of Hancock, Brooke, Ohio and Marshall in West Virginia.

Note: Division No. 4 constitutes Federal Reserve district No. 4 (except Erie, Pa., eastern Kentucky and Ohio) and West Virginia, and that part of Pennsylvania not included in Division No. 1.

4-C. West Virginia District—All of West Virginia, except Hancock, Brooke, Ohio and Marshall counties.

5-A. North Ohio District—All of Division No. 5 north of a line drawn east and west through Ashland, O., (except Erie county) and Columbiana county.

Note: Division No. 5 constitutes Federal Reserve district No. 4 (except Pennsylvania).

5-B. South Ohio District—All of Division No. 5 south of a line drawn east and west through Ashland, O., (except Columbiana county) and Erie county and includes Canton, Massillon, Alliance, Lima, Bucyrus, Marion, Sandusky and East Liverpool.

6-A. Chicago District—Chicago switching district, the Counties of Lake and DuPage in Illinois and Lake county in Indiana, and the Counties of Kenosha, Racine and Milwaukee in Wisconsin.

6-B. Indiana-Illinois District—All of Indiana except Lake county; all of Illinois in Division No. 6 (except Lake county and Chicago switching district), all of Minnesota and Iowa and Wisconsin (except Kenosha, Racine and Milwaukee counties).

Note: Division No. 6 constitutes Federal Reserve district No. 7 and No. 9.

6-C. Detroit District—Counties of Monroe, Lenawee, Jackson, Wayne, Oakland, Macomb and Washtenaw, Michigan.

6-D. Michigan District—All of the State of Michigan ex-

cept counties embraced in District 6-C.

7-A. Colorado District—State of Colorado.

7-B. St. Louis District—St. Louis and St. Louis county, Missouri, Madison and St. Clair counties, Illinois.

7-C. Midcontinent District—All of Division No. 7, not included in Districts 7-A, 7-B.

Note: Division No. 7 constitutes Federal Reserve district No. 8 (except Tennessee, Mississippi and Arkansas) and No. 10.

8-A. Seattle District—States of Washington, Oregon and Nevada.

8-B. San Francisco District—All of California north of a line drawn east and west through Fresno, Calif.

8-C. Los Angeles District—All of California not included in District No. 8-B and all of the state of Arizona.

8-D. Utah District—All of the State of Utah.

8-E. El Paso District—All of Division No. 8 not included in Districts 8-A, 8-B, 8-C and 8-D.

Note: Division No. 8 constitutes Federal Reserve district No. 12 and that part of Federal Reserve district No. 11 not included in Division No. 3.

Schedule C

Minimum Rates of Pay for General Labor

District	Minimum Rates, General Labor—Cents per Hour
1-A. Eastern District	35
2-A. Buffalo District	38
3-A. Southern District	25
3-B. Birmingham District	27
4-A. Johnstown District	37
4-B. Pittsburgh-Wheeling District	40
4-C. West Virginia District	37
5-A. North Ohio District	40
5-B. South Ohio District	37
6-A. Chicago District	40
6-B. Indiana-Illinois District	37
6-C. Detroit District	40
6-D. Michigan District	37
7-A. Colorado District	40
7-B. St. Louis District	37
7-C. Midcontinent District	35
8-A. Seattle District	38
8-B. San Francisco District	37
8-C. Los Angeles District	35
8-D. Utah District	39
8-E. El Paso District	25

Schedule D

List of Unfair Trade Practices Relating to Miscellaneous Castings

This schedule relates solely to the production and/or sale of miscellaneous castings, and has no application to specialties.

For all purposes of this code, it shall be an unfair trade practice for any member engaged in the miscellaneous castings branch of the industry to do any of the following acts:

Sect. 1—Make or promise to any purchaser or prospective purchaser of any product, or to any officer, employe, agent or representative of any such purchaser or prospective purchaser, any bribe, commission or split-commission, gratuity, gift or other payment or remuneration, directly or indirectly.

Sect. 2—Extend to any purchasers special privileges or concessions, including allowances for machining and/or welding (except where explicitly agreed upon to repair specific imperfect castings), pattern alterations, or other services not extended by the industry to all buyers under like terms and conditions.

Sect. 3—Purchase from customers goods and/or services at prices higher than the market for such goods and/or services, for the purpose of influencing or inducing the purchase of castings.

Sect. 4—Absorb all or any part of the machining cost of castings sold as machined castings.

Sect. 5—Enter into quantity contracts with buyers without obligation on their part to take delivery of the quantities specified in the contract or on the quotation, for the purpose of giving special unwarranted prices.

Sect. 6—Either directly or indirectly discriminate in price between different purchasers of steel castings, when the effect of such discrimination may be substantially to lessen competition or tend to create a monopoly, *provided*, however, that nothing herein contained shall prevent differentiation in the price between purchasers on account of differences in the grade, quality or quantity of steel castings sold, or the credit standing of the purchaser.

Sect. 7—Sell or advertise for sale and/or mark steel castings with the intent to mislead or deceive purchasers or prospective purchasers regarding their quality, composition or service features.

Sect. 8—State in the invoice of any product sold by a member of the industry as the date thereof a date later than the date of the shipment of such product, or include in any invoice any product shipped on a date earlier than the date of such invoice, for the purpose of furnishing such product at prices lower than would otherwise prevail or for the purpose of extending the customer's time of payment.

Sect. 9—Allow terms of payment other than net 30 days from date of shipment or a discount of one-half of one per cent, provided payment is made within 10 days from date of shipment.

Schedule E

List of Unfair Trade Practices Relating to Specialties

This schedule relates solely to the production and/or sale of specialties and has no application to miscellaneous castings.

For all purposes of this code it shall be an unfair trade practice for any member engaged in the specialties branch of the industry to do any of the following acts:

Sect. 1—To make terms of payment in connection with sale for domestic use more favorable to the customer than 30 days net cash from date of invoice.

Sect. 2—To make for the purpose of influencing a purchase any promise as to delivery or other matters which obviously is impossible of performance.

Sect. 3—To employ any unfair trade practices which may be established for any product classification by the administrative agency for such classification appointed in accordance with Article VII of this code and approved by the President.

Book Review

Prevention of Automobile Accidents by Victor W. Page, paper, 172 pages, 4¼ x 6½ inches, published by the Norman W. Henley Publishing Co., and supplied by THE FOUNDRY, Cleveland, for 50c and in Europe by the Penton Publishing Co. Ltd., London.

If rules of conduct outlined in simple and easily understandable language in this book can be assimilated properly by motorists and those intending to become car drivers, many preventable accidents will be avoided, costly equipment conserved and human lives saved. The text presents the basic rules for safety in motoring, discusses automobile accidents and their prevention, outlines the need for inspection and adjustment of the automobile mechanisms to prevent accidents, suggests the ordinary driving courtesies which should be followed, details hand and traffic signals and offenses, infractions and penalties imposed, stresses responsibility of car operator, etc.

Type F Jar ramming Power Turn-over Power Draw Machines

We Build 61 Types of Machines for Molding Castings

We Build 14 Types of Machines for Making Cores

Type SB Core Blower

To insure MAXIMUM OUT-PUTS, MINIMUM MOLDING COSTS and LOWEST MAINTENANCE EXPENSE use - - - - - INTERNATIONALS

INTERNATIONAL MOLDING MACHINE CO.

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Schedule Changes Pricing of Pig Iron

Important changes in the pricing of pig iron are revealed in the schedules filed by producers under the terms of the iron and steel code according to *Steel*.

Delivered prices at the principal consuming points are determined by adding to the base price the freight charge from the basing point to the place of delivery. With a number of new basing points established, this policy has the effect of discouraging sellers from wandering beyond their natural trade areas. It will tend to localize the pig iron business of the country.

For foundry, malleable, open-hearth basic and bessemer pig iron, 20 basing points are established, as follows: Everett, Mass.; Bethlehem, Birdsboro and Swedeland, Pa.; Sparrows Point, Md., and Buffalo, serving the Atlantic seaboard territory; Neville Island and Sharpsville, Pa. and Youngstown serving the Pittsburgh area; Erie, Pa.; Cleveland and Toledo, O.; and Detroit serving the lower lake region; Hamilton, O., serving Ohio river points; Duluth; Chicago and Granite City, Ill., serving the upper Mississippi valley; Birmingham, serving the South and northern water and rail markets; and Provo, Utah, serving the Pacific coast.

Basing points for low phosphorus pig iron are Birdsboro and Steelton, Pa.; Standish, N. Y. and Johnson City, Tenn.

The descriptions No. 1X and No. 2X disappear from pig iron lexicons, and for each 0.25 silicon above 2.25, which is the top of the range for ordinary No. 2 foundry iron, an extra of 25 cents per ton is added to the selling price.

Sees Demand for Creation of Machines

Manufacturers of machinery and parts have been concerned with the apparent policy of the national recovery administration to discourage the introduction of "Labor saving" equipment. The cotton textile code carries restrictions on the hours machinery may be operated. The steel code bans the installation of new steelmaking capacity. General Johnson, while stating that "necessary installation of new equipment should go forward," makes this reservation: I do think that for a short period it would be wise to not emphasize the installation of machinery that tends to further reduce the field of employment.

These signs indicate that the government wishes to forego some of the advantages of machines—at least in the early stages of recovery. Apparently it ignores the fact that proper utilization of machines would provide more jobs in the plants of machine and parts manufacturers.

Fortunately the situation probably will right itself as the nation jumps farther into the recovery program. In standardizing hours and wages and discouraging the addition of new capacity, the government virtually makes efficiency, instead of price, the chief weapon of competition.

This means that employers, having hired more workers and raised wages, will try to offset increased costs by greater efficiency. Thus a new demand for "labor aiding" devices will be created.

Manufacturers are awake to this necessity. A number of machinery companies already are engaged on designs for "aiding" labor. As this trend develops and expands, the machinery industry will assume its rightful place in the recovery program.—*Machine Design*.

New Basing Points and Delivered Prices of Pig Iron

(Delivered prices do not include switching charges, except as noted, or freight surcharges. 25-cent differentials apply for each 0.25 silicon above 2.25.)

Gross Tons

	No. 2 Fdry.	Malleable	Basic	Bessemer
Basing Points:				
Bethlehem, Pa.	$17.50	$18.00	$17.00	$18.50
Birdsboro, Pa.	17.50	18.00	17.00	18.50
Swedeland, Pa.	17.50	18.00	17.00	18.50
Sparrows Point, Md.	17.50	18.00	17.00	18.50
From Swedeland, Pa., del. to Phila.	18.26	18.76	17.76	19.26
Basing Points:				
Everett, Mass	18.00	18.50	17.50	19.00
From Everett, del. to Boston, flat rate, with surcharge	19.00	19.50	18.50	20.00
Buffalo	17.50	18.00	16.50	18.50
Buffalo, del. to Boston	19.00	19.50	18.50	20.00
Bethlehem, del. to Brooklyn	19.77	20.27	19.27	20.77
Bethlehem, del. to Newark, N. J.	18.89	19.39	18.39	19.89
Basing Points:				
Neville Island, Pa.	18.00	18.00	17.50	18.50
Sharpsville, Pa.	17.50	17.50	17.00	18.00
Youngstown, O.	17.50	17.50	17.00	18.00
From Neville Island, Pa., del. to Pittsburgh	(Neville Island base, plus 50 to 76 cents switching charges)			
Basing Points:				
Erie, Pa.	17.50	18.00	17.00	18.50
Cleveland	17.50	17.50	17.00	18.00
Toledo, O.	17.50	17.50	17.00	18.00
Detroit	17.50	17.50	17.00	18.00
From Detroit, del. to Saginaw, Mich.	19.60	19.60	19.10	20.10
From Cleveland, del. to Akron, Canton, O.	18.76	18.76	18.26	19.26
From Toledo, del. to Mansfield, O.	19.26	19.26	18.76	19.76
Basing Point:				
Hamilton, O.	17.50	17.50	17.00	18.00
From Hamilton, del. to Cincinnati	18.51	18.51	18.01	19.01
Do., del. to Indianapolis	19.77	19.77	19.27	20.27
Basing Points:				
Duluth	18.00	18.00	.....	18.50
Chicago	17.50	17.50	17.00	18.00
Granite City, Ill.	17.50	18.00	17.00	.....
From Duluth, del. to St. Paul	19.94	19.94	.....	20.44
From Chicago, del. to Milwaukee	18.50	18.50	18.00	19.00
From Chicago, Toledo or Detroit, del to Muskegon, Mich.	20.40	20.40	19.90	20.90
From Granite City, del. to St. Louis	(Granite City base, plus 56 to 75 cents switching charges)			
Basing Point:				
Birmingham, Ala.	13.50	.....	12.50	.....
From Birmingham, del. to:				
Boston, dock	19.38	.....	18.38	.....
New York, dock	19.13	.....	18.13	.....
Philadelphia, dock	18.88	.....	17.88	.....
Baltimore, dock	18.63	.....	17.63	.....
Cleveland	19.64	.....	18.64	.....
Cincinnati	18.23	.....	17.11	.....
Chicago	18.16	.....	19.14	.....
St. Louis	18.05	.....	17.05	.....
Basing Point:				
Provo, Utah	16.50	.....	.....	.....

LOW PHOS.

Basing points: Birdsboro, Pa., Steelton, Pa., and Standish, N. Y.—$22.00. Basing point: Johnson City, Tenn.—	.....
Philadelphia, standard and copper bearing	23.13

GRAY FORGE

Valley furnace	17.25
Pittsburgh, district furnace	17.75

CHARCOAL

Lake Superior, furnace	20.50
Do., del. Chicago	23.54

SILVERY

Jackson County, O., base: 6%—$22.25; 7—$23.25; 8—$24.25; 9—$25.25; 10—$26.25; 11—$27.75.

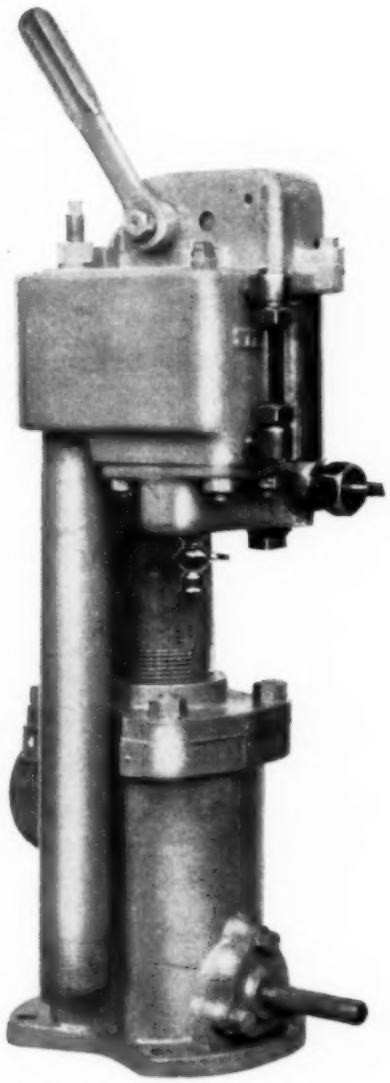
BESSEMER FERROSILICON

Jackson County, O., base: 10%—27.25; 11—$28.75; 12—$30.25; 13—31.75; 14—$33.25; 15—$34.75; 16—$36.25.

IF IT'S A HERMAN IT'S WORTH USING.
IT MADE ITS WAY BY THE WAY IT'S MADE

-HERMAN-
MOLDING
MACHINES

Automatic Fluid Timing Valve



INSURES all molds being rammed to the same density thereby eliminating the guesswork.

Relieves the operator of counting the number of blows, allows him to attend to other duties while the machine is jarring.

May be attached to any make and size of Jarring Machine.

Is attached to the air supply line and is independent of the Jarring Machine. Is simple in construction and reasonable in cost.

MADE IN THE FOLLOWING SIZES

Number 1 for Pipe sizes $\frac{1}{4}$" to $\frac{3}{4}$", inclusive
Number 2 for Pipe sizes 1" to $1\frac{1}{2}$", inclusive
Number 3 for Pipe sizes 2" to $2\frac{1}{2}$", inclusive

PLEASE WRITE FOR PAMPHLET
AND PRICES

HERMAN PNEUMATIC MACHINE COMPANY
GENERAL OFFICES: Union Bank Building PITTSBURGH, PA.
MANUFACTURING PLANT: ZELIENOPLE, PENNSYLVANIA, U. S. A.
Foreign Works: Pneulec Limited, Mafeking Rd., Smethwick, near Birmingham, England
Hartung Aktiengesellschaft, Berlin, Lichtenberg, Germany
Gibson Battle & Co., Limited, Sydney, N. S. W.

Settling a little point in etiquet

The Adventures of Bill

BY PAT DWYER

KINDLY throw your eye over this document." The foregoing sentence might lead the innocent reader to infer a deep and dark tragedy incident to the discovery that the document, usually referred to colloquially as the papers, was filled with legal dynamite or TNT. Following the style of the literary gents who grind out these thrillers let me hasten to assure you "That such is not the case."

The announcement or invitation or whatever you have a mind to call it, came from Bill. He extended for my inspection or eye throwing exercise a disreputable looking sheet of paper bearing on the surface several large black blotches and with the lower right corner entirely missing.

Answering the unspoken question indicated by a delicately lifted eye brow he hastened to assure me that the blotches represented thumb and finger prints.

"This bird," he explained plaintively, "shoved the thing into my hands just after I had finished showing one of my apprentices how to black a mold in the way it should be blacked and that means without depositing about a gallon of the fluid in the bottom. The corner was burned off later when I accidentally laid it down on a smoldering stogie, but enough of the thing still is visible for you to get the general drift. See what I mean?"

"Before I don the old diving suit and sink into the depths would you mind giving a few details to serve as a kind of a general guide. What is this remarkable document? Who is the bird and what induced him, her or it, to place it in your black paws? In a word, and not to put too fine a feather edge on the proposition, what is it all about?"

"Well," said Bill, "I'll tell you. This here bird I'm telling you about came in to sell me some sand. Just a natural born optimist. I regretted the fact that at the moment I was not in the market for sand and that naturally turned the conversation on the probably increased prospects under the provisions of the New Deal. This brought him bouncing up with a new grievance. Where, he wanted to know, did the sand men get off in this here now new deal? All the big fellows, the steel men, the oil men, the coal men and all the rest of 'em have drawn up codes for their guidance and deliverance. The sand men for one reason or another have taken no action.

"After brooding over the situation for a reasonable length of time he had hatched out and drawn up a code and he now proposed to parade his flock of chickens before other sand producers and later bring them to the attention of the national administration. Before presenting these brain chickens to his colleagues—who could be depended upon to make the feathers fly—he would appreciate my opinion from a consumer's viewpoint. I told him the subject was too important for snap judgment. If he would trust the precious document to me for a few days I promised to study it carefully and then furnish him with a mature and well considered comment.

"Now," Bill concluded courteously, "before returning the code to the author I should like to have you throw your eye over it. Possibly you may be able to heave a weasel word or two in here and there where they will do the most good, or, on the other hand you may spot a word or two which might be omitted to the pleasure and profit of all concerned.

Just like little orphan Annie

"Let us begin at the beginning. You will note that the code is addressed to Gen. Hugh S. Johnson, Washington, D. C., Dear Gen.:

"Unfortunately I am not in a position to check up on this highly important point. Do you happen to know whether the General spells his name Johnson or Johnston? The average man is extremely touchy on this name spelling business and of course this touchiness is magnified to at least 25 diameters in a military citizen with the rank of general."

"The address is correct," I said. "The General's son spells his name with a *t*, but the old war horse spells his name as you have it."

"Shades of '76 and the Boston tea party! He will have nothing to do with the *t*, eh? That's the boy for me. Clearly we shall have to change that salutation Dear Gen."

"What's wrong with Dear Gen.?"

"Too ladylike, my lad, too effeminate. It does not look too bad in the written or printed form, but just say it and what have you? Why, Dear Jenn of course and that's the pet name for Jenifer. Almost invariably the name is linked with Anne and then we have the horrible combination under which innumerable innocent little maidens have suffered for years until mercifully released by matrimony or a plunge into stage life. No. We cannot have any Jen or Jennyanne on this important document. That's out. You might just as well address the General as Dear Hughie and expect to get away with it. What we want is something dignified and yet not too stilted, personal and yet not too familiar."

"Address him simply as Comrade. He will think you are either one of the forty hommes or the eight cheveaux. Your code will have immediate attention. Way there! Make way

for the boys of the old brigade. What's next?"

"Plenty," said Bill. "Plenty and then some. The General's or—in the amended form—the comrade's attention is directed to the fact that the forgotten man again has been forgotten. Foundrymen have prepared and presented elaborate codes, but a careful perusal of these codes fails to disclose any features applying to the sand men. With all due respect Comrade Johnson is reminded that without a supply of sand the foundries would cease to function. Sand is a basic necessity even when used in acid practice—"

"I should advise you to cut out that last sentence. A jest is all right in its place but is rather hard to explain to a nontechnical man. Stick to the plain facts."

"What do you mean, jest?" Bill inquired. "Oh, I get you, basic and acid. Well, out she goes. I think also I shall cut out the remainder of the preamble touching on the annual production, transportation, freight rates, samples, collections, credits and the reprehensible custom of foundrymen in using sand until it is worn out instead of keeping their heaps fresh and sweet by daily additions of large quantities of virgin sand. This brings us down to a consideration of the code properly laid out in numbered sequence.

1—For the purpose of classification sands shall be listed as green sand, black sand, dry sand, core sand, silver sand, sugar sand, sandblast sand, old sand and/or quick sand. Green sand shall be used exclusively in all aluminum, brass and/or malleable foundries and to a preponderating extent in all gray iron and/or steel foundries. However, it shall not be deemed a violation of the code to supply sand of other hues to founders in the black North, or to others actuated by patriotic or equally commendable motives. No orders for blue, mauve, heliotrope, pink, cerise, orchid and/or lavender sand will be accepted.

"That seems to cover the ground, eh?"

"You might insert carnation, scarlet, violet and purple. Carry on."

2—To co-operate fully with the sand producers, all foundrymen are requested to discard all black sand daily and start each day with a supply of new sand. Careful tests by the Upward and Onward association show that dark thoughts and gloomy forebodings characterize employes of these dark caverns in which the floor is covered with black sand. As compared with the number of men in light shops covered with new sand who poison their wives and throw their children down deep wells, the ratio is 9.76 to 1.

3—The term Sandman wherever it shall appear in this code applies only to a firm, individual, company and/or concern engaged in the business, occupation or profession of digging, lifting, lugging, toting, carting, trucking, shipping and/or otherwise transporting sand from its native habitat—bank, pit or deposit to you—and later dumping it in the foundry yard, back of the dog house, in wood or concrete sand bins, or in any other form of suitable container the recipient may elect.

4—Efforts and product of the slinky, pussy footed sand man who hovers like a bat at twilight and puts children to sleep by dusting invisible sand in their eyes, come under the head of unfair competition, clearly infringe on the rock-a-bye baby patents and will not be tolerated.

5—Subscribers to this code vigorously deny any connection *de jure, ipso facto, habeas corpus and/or corpus delicti* with all counterfeiters and chiselers who masquerade as sand men under such titles as sand pipers, sand wiches, sands of the desert which grow co-o-ol-d, footprints in the sands of

Sand from the dog house usually yields more startling treasures

time, little grains of sand, sand suckers, sand paper, sand bags, sand baths, ropes of sand, sand glass and/or sand pumps. *Verb sap.*

"Too much Latin in that section. I think you should cut out that verb sap."

"Out she goes," Bill agreed heartily. "No need of calling these birds saps, even if they are competitors. Keep the thing clean."

6—Upon patriotic grounds and in line with the provisions of the Soak-em-Sockem act regulating imports of foreign materials, subscribers to this code pledge themselves to handle none of the golden sands rolled down from Afric's sunny fountains. Nothing in the foregoing shall be considered prohibitory to a change of mind if and when the United States shall return to the gold standard.

"Something in that," Bill commented, "reminiscent of what the old colored woman said when a corporal's guard of neighbors, moved more by sanitary than Christian motives, came to bury a lately deceased and cantankerous husband, 'Praise de Lor,' Ah hopes he's gone whah Ah specs he aint! Apparently she knew him.

7—Market quotations on sand shall not be affected by fluctuations in the value of the rouble, the death rate in Manchuria, the price of baled hay in Peru, number and value of bull hides imported from the Argentine, rise and fall of the tides, nautical phenomena including the number of schooners in ballast and empty passing over the bar of any given city in one calendar month, fluctuating relationship between bottom thickness and foam on steins, mugs, seidels and/or tankards. Provided, however, that nothing in the foregoing shall be construed as a restriction on the freedom of operators to re-figure prices on a close contract or at their discretion.

8—Subscribers to the code reserve the right to set a trade-in value on all old sand. To be acceptable for trade-in purpose the sand must be reasonably neat and clean, free from all foreign material including core butts, scrap, tobacco, half bricks, gaggers and soldiers, charcoal, coal dust, sour paste, clay wash, coke and cinders, old bags, dead rats, luncheon remains, beer bottle caps, nails, chaplets, wedges, oil, silica wash, talc and plumbago.

"Seems to me," said Bill, "we should add another clause to that. The stipulation is fairly comprehensive, but it still leaves one or two loop holes through which the foxy foundryman might realize on his old sand. In these days of purity and uplift in business every effort should be made to remove him from the zone of temptation. I am sure the bird who gave me the paper will welcome the final clause. Nine is a lucky number.

9—Maximum and minimum sizes under which old sand may be returned. In the North and South all old sand which remains on a 40-foot ladder will be accepted. In the East and West all old sand which passes through a vigorously shaken ½-inch riddle is hereby considered ineligible for return purposes under the provision of the code covering the sand industry.

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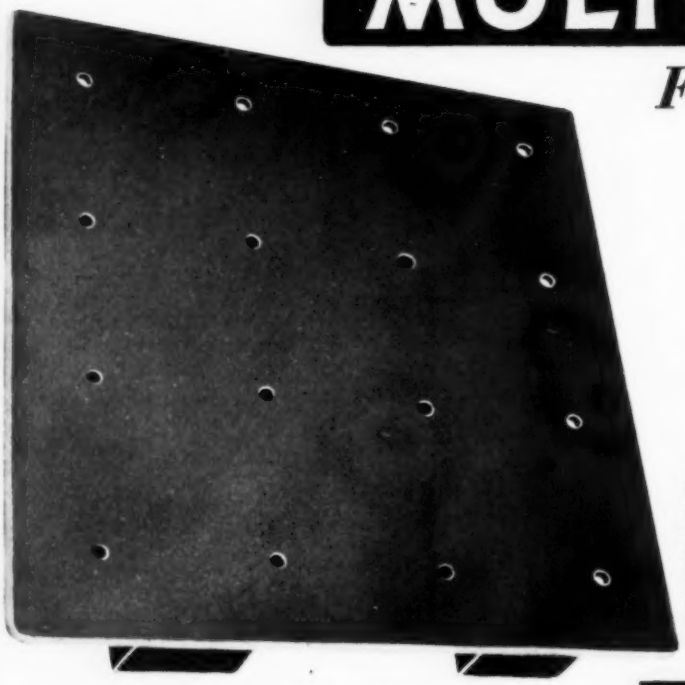

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(*Concluded from Page* 12)

room. Cores are baked in rack type ovens and a special asbestos curtain has been installed in front of the ovens to protect the employes in that department from excessive heat.

Gray iron produced by the Belle City company is called Belectric, a combination of the company name and the melting process employed. The iron has an all pearlitic structure with finely divided particles of graphite evenly dispersed throughout the matrix. The brinell hardness ranges from 160 to 300, but due to the structure the company has found that the iron in higher brinell hardness ranges will machine as readily as many softer irons. The iron is produced regularly in several grades including the following which have been designated as No. 1, No. 2 and No. 3.

Made in Three Grades

No. 1 iron has a total carbon content of from 3.10 to 3.25 per cent, silicon from 2.20 to 2.40 per cent and manganese from 0.60 to 0.80 per cent. In the as cast condition the iron has a tensile strength of from 35,000 to 42,000 pounds per square inch, a transverse breaking load of 4000 to 4500 pounds, a deflection of 0.13 to 0.16-inch and a brinell hardness of 190 to 200.

No. 2 iron has a total carbon content from 2.80 to 3.00 per cent, silicon from 1.80 to 2.00 per cent and manganese from 0.60 to 0.80 per cent. Tensile strength in the as cast condition is from 42,000 to 50,000 pounds per square inch, transverse breaking load of 5000 to 5500 pounds, deflection 0.13 to 0.16-inch and brinell hardness 220 to 230.

No. 3 iron has a composition which is varied from that used for No. 2 iron, with suitable alloy additions depending upon the particular requirements of the casting in service. Physical properties of No. 3 iron in the as cast condition are as follows: Tensile strength, 50,000 to 60,000 pounds per square inch, transverse breaking load of 5500 to 7500 pounds, deflection 0.13 to 0.20-inch and brinell hardness 240 to 300. All determinations were made on a standard 1.25 inch test bar.

An iron which has a composition to provide great ease in machinability has a total carbon content of 3.30 to 3.50 per cent, silicon 2.20 to 2.40 per cent and manganese 0.60 to 0.80 per cent. Tensile strength ranges from 26,000 to 33,000, transverse strength from 3500 to 4000 pounds and brinell hardness from 160 to 180 brinell. In all of the irons, the phosphorus is under 0.20 per cent and the sulphur under 0.08 per cent. All of the irons may be heat treated to obtain beneficial results in certain properties.

A number of interesting tests have been performed by other companies at the request of the Belle City company to determine certain properties of various types of castings made from one of the irons previously discussed. In one series of tests, experiments were made to find the wearing qualities and load carrying capacities of gears made from No. 2 iron. The proportion of the gears were as follows: 109 teeth, 5 D.P., 30 degrees spiral angle, 25 degrees pressure angle, 4½-inch face. The gears were meshed with alloy steel pinions with 9.9:1 ratio, and the velocity of the gears at the pitch line was 286 feet per minute.

The load test on a gear of that type showed a failure at a load of 22.5 horsepower. The brinell hardness was 229, the total carbon content 2.88 per cent, the silicon content was 2.09 per cent, the modulus of elasticity 23,000,000 pounds per square inch, the apparent proportional elastic limit in shear 33,000 pounds per square inch, the shear stress below surface at failure 39,200 pounds per square inch, and the pressure per inch of face at failure 1740 pounds.

Good wear resistant qualities were shown by the test. On a gear loaded at 18 horsepower for 50 hours and then at 22.5 horsepower for 70 hours, the maximum wear at any one point was 0.003-inch at 0.090-inch from the top of the tooth. Readings were taken at six different points and at four points no wear was recorded. A series of fatigue tests on specimens of the iron indicated the endurance limit is between 41 and 42 per cent of the tensile strength.

An interesting test also was made by an automobile manufacturer on 11-inch gray iron brake drums made by the Belle City company. Chemical analysis was as follows: Total carbon, 2.86 per cent, manganese 0.92 per cent, phosphorus 0.275 per cent sulphur 0.035 per cent, silicon 2.34 per cent, nickel 0.77 per cent, molybdenum 0.54 per cent and chromium 0.12 per cent. In the dynamometer test 500 eight-second stops were run on the drum with a load of 81,000 foot-pounds. The drum and lining wear were measured and then 400 eight-second stops were made with the load increased to 125,000-foot-pounds. The average wear per 100 stops with the first load was 0.000162-inch and with the second load 0.000516-inch.

Addition of high quality gray iron castings to its line of steel and malleable iron castings, makes it possible for the representatives of the Belle City Malleable Iron Co. to give the customer and designing engineer first hand information on all three classes of ferrous castings. It can make recommendations as to the best material for the particular service which the customer has in mind, and then be in a position to bid on the business, regardless of the material used. Few foundries in the United States are so equipped to make steel, gray iron and malleable castings.

Book Review

We Have Recovered Before?, by Walter W. Price, paper board, 102 pages, 5½ x 8 inches, published by Harper & Brothers, New York, and supplied by THE FOUNDRY, Cleveland, for $1.50 and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

As the title would indicate, the author is optimistic regarding the future prosperity of this country. He has pointed out that our country has witnessed other depressions; that, relatively, those were regarded at the time by those who lived in them as being as menacing and serious as the one now existing, but in each case human nature has recovered itself to such an extent that it has forgotten the extremities through which it passed. The author has abandoned the highly specialized language of the usual writer on economic subjects, and has presented the discussion in such an interesting manner that it holds the attention of the reader throughout.

With the thought in the background that history constantly repeats itself, the author undertakes to trace developments in the major depressions of this country, to show those happenings of the past which are almost identical with the sensational developments of the present day. He points out that the widespread character of depressed conditions is not unique, and then presents a table showing the periods of panic in France, England and the United States.

Presents Data On Numerals In Butane

The fourth number of *Sands, Clays and Minerals*, published in July by Algernon Lewin Curtis, Chatteris, England, includes articles in "Fluorspar in Industry" by A. Wilson; "The National Sand Association," by A. L. Curtis; "British Standard Industrial Screens and Sieves"; "Cobalt and Its Uses" by L. Sanderson; "English China Clay" by A. R. Davies; and "Notes on Sand Analysis."

Phosphorus in Cast Iron-II

(*Continued from Page* 18)

follows: Sulphide, ferrite, pearlite, cementite, phosphide, graphite.

In a more extensive investigation Shipley and McHaffie in the *Journal of Industrial & Engineering Chemistry*, June, 1924, have shown the order of corrodibility as determined by electropositive character, to be ferrite, pearlite, phosphide-eutectic, massive cementite and graphite. From this it is evident that steadite in itself resists corrosion. It is reasonable to suppose that in high percentage it may lessen the corrodibility of the metal. In lower percentages it may have a detrimental tendency in promoting electrolytic action.

Stumper in the *Iron and Steel Industry*, May, 1928, investigating the effects of corrosion on pipe lines, showed that the action of corroding media was to eat away the pearlitic matrix, leaving a network of graphite flakes and steadite.

Network Hinders Gas Penetration

Tests by Kennedy and Oswald, *Transactions* of the American Foundrymen's Association-1926; by Bazant in *Die Giesserei Zeitung*, May 1, 1928, and by others show steadite when in network formation hinders the penetration of oxidizing gases, and in this manner promotes growth resistance at moderately elevated temperatures.

The exact constitution of steadite in gray iron has been a disputed subject among metallurgists. Stead claimed that although the ternary phosphide eutectic occurs in white irons, the formation steadite in gray irons is largely a binary eutectic formation. Wust and a number of other investigators claim that the ternary form is found in some gray irons. Some go so far as to claim that the ternary form is a common component of gray irons.

Careful study of this problem has convinced the author that the following explanation is correct. The existence of the ternary formation in white irons is established clearly. During the graphitization reaction occurring in the formation of gray irons the carbide of the ternary eutectic diffuses out, and under suitable cooling conditions, and with suitable compositions only the binary formations are left. However, if cooling is too rapid to permit complete diffusion of carbon (carbide) from the ternary formation some of this remains in the steadite. If cooling is slow and phosphorus well under 0.50 per cent the steadite may appear structureless. If the iron is annealed at 1600 degrees Fahr. or above the steadite is broken down, the Fe_3P slowly going into solid solution in the ferrite.

If the ternary eutectic were found in slowly cooled gray irons an iron with 0.70 per cent phosphorus and 0.28 per cent combined carbon would show no pearlite—a condition not checking with available microscopic evidence. Some years ago in connection with some work being done with MacKenzie, the author carefully annealed some 0.60-0.70 per cent phosphorus irons, so that these showed only ferrite, graphite and steadite. Careful analyses for graphite, total carbon, and combined carbon showed that little if any combined carbon was left. Obviously with 0.70 per cent phosphorus there should have been 0.28 per cent combined carbon if the steadite were a ternary formation.

Definite evidence of residual ternary formation was encountered several years ago by the writer during the examination of some ⅛-inch square section "hard" automotive piston rings. These analyzed as follows:

	Per cent
Total carbon	3.55
Combined carbon	0.65
Silicon	2.85
Phosphorus	0.50
Sulphur	0.085
Manganese	0.60

The general structure revealed the presence of some free ferrite as well as a rather large amount of a harder white substance containing phosphorus and carbide. It will be noted that the analysis is one usually indicating a pearlitic matrix. This led to investigation of a series of irons. Many samples have been found which definitely showed cementite lamellae projecting from steadite "crystals" and the migration of cementite from the partially ternary formations, has been studied carefully.

In some instances pearlite was found in steadite as indicated in Fig. 10. Samples carefully etched with alkaline sodium picrate showed that this reagent can be used to differentiate those regions richer in carbide, as shown in Figs. 6 and 7. In Fig. 6, the medium gray to black cellular structure is steadite. Experiments have shown that the dark portions contain some cementite. Note the almost complete absence of pearlite from the little cell spots. Note in Fig. 7 the graduations from gray to black in the phosphorus-rich portions, also the presence of cementite lamellaes in some of the cells. The "carbide-rich" areas show darker. Kunkele in *Mitteilungen, Kaiser Wilhelm Institute fur Eisenforschung*, Vol. 12, 1930, paper 145, advocates treatment with boiling 5 per cent chromic acid followed by heat tinting, to distinguish between iron carbide and iron phosphide.

The author also found that it was quite possible to locate samples where the cementite divorcement was quite complete. A steadite "crystal" in which carbide divorcement is partial is shown in Fig. 8. Note the white honeycomb steadite structures surrounded by the cementite lamellae of pearlite. The rounded cells are free from pearlite and few cementite lamellae are attached to the outside boundary of the steadite crystal.

Incidentally, carbide, when present most frequently is found largely in the phosphide itself rather than in the iron-rich part of the steadite. Annealing experiments indicate that carbide may be removed completely with ease and if the temperature is high and time prolonged complete solution of the phosphide itself results. In low phosphorus irons it is not unusual to find structureless formations, shown by the author in previous articles in THE FOUNDRY, May 15, 1926.

Recapitulating, steadite in gray iron usually is largely a binary formation. This binary formation probably is a decomposition product of a ternary formation, and in many instances retains small amounts of carbide. The amount so retained depends on the time of cooling and other factors which affect the stability of carbides in general. In small rapidly cooled castings it is even possible for free ferrite and steadite retaining considerable carbide to coexist, and mysterious cases of hard castings have been traced to this phenomenon. In a sense phosphorus has a mild stabilizing influence on the carbides.

Advance Ingenious Explanation

Kunkele and Bardenheuer have advanced an ingenious explanation of the constitution of steadite, employing concepts adhered to by proponents of the "double" iron carbon equilibrium diagram. Kunkele states that iron-phosphorus-carbon alloys may form according to the stable system iron-graphite-phosphide or according to the metastable system iron-iron carbide-iron phosphide. The latter coincides with the author's observations, as previously stated.

In the first case Kunkele and Bardenheuer state that the ternary solid solution consists of graphite, iron phosphide and solid solution. The graphite migrates out of the ternary eutectic, going to pre-existing flakes and leaving the steadite free from graphite, a so-called "pseudo-binary" formation. The author has not seen anything which indicates that graphite exists in steadite other than accidentally. Kunkele and Bardenheuer insofar as is known have not been able to isolate such a formation; solid solution-graphite-iron phosphide. If this eutectic base does occur it seems that it would have been isolated in some of Kunkele's quenching experiments.

Kunkele also obtained cooling curves on irons containing about 2 per cent phosphorus, 3.2 per cent carbon and silicon from traces to 5 per cent. When silicon was increased to 2 per cent and

(*Concluded on Page* 54)

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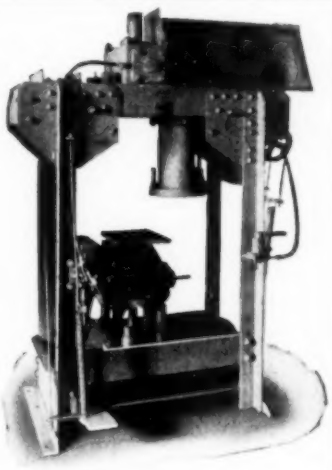

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◆ ACTUAL STATEMENT FROM A LARGE PENNSYLVANIA FOUNDRY

(*Concluded from Page* 52)

over, the "pseudo binary formation" solidified at 1760 degrees Fahr. whereas below 2 per cent silicon the ternary formation solidified at 1744 degrees Fahr. Kunkele noted that silicon raises the eutectic temperature, in a progressive manner, but the change or "step" of 16 degrees Fahr. in solidification point just above and below 2 per cent silicon is comparatively well marked. Kunkele attributes this "step" as marking the change from metastable (cementite) to stable (graphite) equilibrium. The author believes that this phenomena might well be attributed to *cementite* rejection, the ternary (cementite) containing formation naturally solidifying at a lower temperature than the binary formation.

Since steadite is approximately 10 per cent phosphorus, and its density not far different from that of gray iron it is obvious that 1.0 per cent of phosphorus will produce about 10 per cent of steadite by volume. The effect of the volume of phosphorus-rich structures in displacement of the eutectic point has been mentioned. Considering steadite as a binary formation, its effect on the amount of combined carbon required for a pearlitic matrix is appreciable. For example, in an iron normally requiring 0.70 per cent combined carbon for a pearlitic matrix (phosphorus absent) would require only 0.63 per cent combined carbon in the presence of 1.0 per cent phosphorus.

This is the second and concluding article on "Phosphorus in Cast Iron." The first installment appeared in the August issue.

THE EDITORS

Industry Needs Improved Machinery

Importance of improved machinery in furthering industrial recovery is stressed in an interesting booklet written by Allen W. Rucker in collaboration with N. W. Pickering, president, Farrel-Birmingham Co., Ansonia, Conn., and published by that company. The authors point out that despite the genuine and wholehearted co-operation of industry in raising wages and shortening the work week, in accepting the prescribed rise in production costs without a proportionate rise in prices being permitted, it is only natural that certain misgivings begin to appear. Most of us recognize that industry is the vehicle for the production and distribution of wealth—that unless industry can continually perpetuate itself through adequate earnings, widespread prosperity can be at best only temporary.

The discussion points out that on the surface the theory of the administration that industrial profits will be provided by greater volume rather than by higher prices is entirely sound. But it does not necessarily follow that the employment of more people for shorter hours assures greater production. It must be considered that in the final analysis the manufacturer's margin between the cost of raw materials and selling prices represents the value added by manufacture, and that, of that value, labor and capital must share equitably if a balanced economy is to result. How great that margin is depends in greater measure not only on the aggregate output of all workers but particularly upon the individual productivity per worker.

Under the Industrial Recovery act, according to these writers, it will be the manufacturer's problem to see to it that the percentage of the value added to raw materials by his processes which he pays to labor is kept within the proper limits.

With shorter working weeks and the higher wages likely to be encouraged by the administration, costs naturally will rise. The discussion brings out that unless not only total production but particularly productivity per worker can be increased, improved purchasing power and greater sales volume will not provide adequate business profits. Even in that year 1929, some 36 per cent of all corporations showed deficits and over 47 per cent failed to earn a taxable profit, while less than 11 per cent earned net profits exceeding $10,000. Greater production in the aggregate is essential, but equally if not more essential is a substantial increase in the productivity of the individual worker.

The probable answer to the situation in the opinion of the authors, lies in the substantially increased use of highly improved and efficient machinery. The more complete and efficient the mechanization of industry, the greater the productivity of the individual in terms of dollars of value added by manufacture per wage earner.

The discussion states that the need for improved machinery to protect industrial earnings and develop greater individual productivity is not, however, contrary to the spirit of the times nor inimical to labor. The writers do not feel that industry should yield to the expressed or implied desire of those who erroneously imagine that machinery improvements tend to curtail employment and create unemployment.

On the contrary, the authors declare the insistence of manufacturers upon having and operating the most advanced and improved types of machinery is precisely the policy which will protect labor against itself, as well as preserve the profits of industry. Over the long term, both the number of workers employed and the average annual earnings per worker tend to increase in those industries which are most advanced in new processes and improved machinery. Labor as well as industry benefits under conditions which result in the maximum productivity per worker.

Improved machinery is the answer to Industrial Recovery, most likely to produce immediate and tangible gains for both capital and labor, in the opinion of these writers. There is no objection to shortening the work week by 20 per cent if individual productivity can be increased correspondingly. There can be no objection to higher wages if output per worker is raised accordingly.

Book Review

Alloys of Iron and Silicon, by Greiner, Marsh, and Stoughton, cloth, 457 pages, 6 x 9 inches, published by McGraw-Hill Book Co., Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $5.00, plus 15 cents postage, and in London by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster.

This is the second volume of the series of alloys of iron monographs published for the Engineering foundation. The work is a comprehensive, critical summary of available data as reported in the technical literature of the world. The authors state that more than 1200 articles in many languages were located and studied in the preparation of the book. Although the authors do not pretend to cover every fact and fancy ever published, the book does include insofar as possible all major facts and data on iron-silicon and associated alloys, exclusive of cast irons which are covered in part.

The authors have made concise arrangement of material and the unity of presentation, the difficulties of which are appreciated when the diversity of source data is considered. The work, of course, is technical in nature, its appeal directed to the metallurgist or to the research worker who wishes a compendium of present knowledge of iron-silicon alloys. Detail consideration is given to constitution and structure, mechanical properties, and electrical and magnetic properties. Silicon-iron, silicon-iron-carbon, silicon manganese, and complex alloys with silicon are discussed in detail. Illustrations and diagrams are numerous, and a complete bibliography is included. Technical subject matter is covered in a thoroughly practical manner.

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MAIN OFFICE: YOUNGSTOWN, OHIO
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DESIGNED AND BUILT TO SUIT THE JOB

Subdivides Cleaning Costs

(*Concluded from Page* 19)

Sponges
Hammers
Brooms
Electric bulbs
Wire brushes

Tumbling Division

All items as under Mill Sandblasting except

1. Direct labor
   Tumble mill operators
4. Miscellaneous Supplies and tools
   Stars and jacks
   Hammers
   Wrenches
   Lubricants
   Waste
   Electric bulbs
   Wire brushes

Pickling Division:

All items as under Mill Sandblasting except

1. Direct labor
   Pickling operators
4. Miscellaneous supplies and tools
   Pickle Acid
   Rubber Boots
   Gloves
   Buckets
   Tongs
   Wrenches
   Hammers
   Goggles
   Wire Brushes

Grinding Division:

All items as under Mill Sandblasting except

1. Direct labor
   Grinder operators
4. Miscellaneous supplies and tools
   Grind wheels
   Wheel dressers
   Goggles
   Hammers
   Wrenches
   Lubricants
   Electric bulbs

Finishing Division:

All items as under Mill Sandblasting except

1. Direct labor
   Filers, chippers, gagers sorters, inspectors
4. Miscellaneous supplies and tools
   Files
   Hammers
   Air hammers
   Straight edges
   Chisels
   Pliers
   Wire brushes
   Electric bulbs, etc.

Shipping Division:

All items as under Mill Sandblasting except

1. Direct labor
   Packers, weighers, loaders
4. Miscellaneous supplies and tools
   Barrels
   Cartons
   Boxes
   Bags
   Cord
   Tape
   Tags
   Stencil ink
   Brushes
   Paint
   Sacks
   Nails
   Crating lumber

It has been our policy to pay all our labor piece work rates instead of day work rates, wherever possible, and this fits in nicely in the cleaning subdivisions themselves, but not for finishing and shipping. Even though work is run piece work, direct and indirect labor hours are tabulated for each subdivision.

Our foundry production of castings made, in pounds, and good castings, in pounds, are kept separated into each of these seven subdivisions. We compute our total costs for each cleaning subdivision as well as a clean and ship department total as follows:

1. Cost per Cwt. of castings through the subdivision
2. Cost per Cwt. of castings good and shipable
3. Cost of all items as per cent of direct labor per Cwt.
4. Cost per direct labor hour.
5. Cost of burden per direct labor hour

Rather than get into a controversy as to the proper computation to use for individual costs, I leave it up to the individual reader to determine for himself which ones he would use. I believe I say "ones" advisedly because we find it necessary to use different methods for different departments and individual jobs.

Book Review

Common Sense About Machines and Unemployment, by Morris P. Taylor, cloth, 173 pages, 5¼ x 8 inches, published by the John C. Winston Co., Philadelphia, and supplied by The Foundry, Cleveland, for $1.50 and in Europe by the Penton Publishing Co., Ltd., Caxton House, Westminster, London.

This book is an endeavor to analyze the problems resulting from the effect of mechanization, to determine why society has failed to use machinery properly, and to consider the control necessary to make machinery further the progress of civilization.

The author believes that unemployment is due not only to the decline in trade, but also to the displacement of workers by machinery. Mechanization has reduced employment directly and trade indirectly. These are not necessarily the effects of the use of machinery, but occur because production and consumption are out of balance. The author points out that if production and consumption were kept adjusted, machinery would improve the average standard of living and advance material civilization. However, it is pointed out that it is not necessary to abandon our social and economic structure and start on an entirely new basis. To accomplish the necessary reforms, a series of reasoned and moderate changes, designed to combine the equities of the present with the well being of the future, has more promise than a complete and immediate change in the present economy. Nevertheless, the author predicts that the future developments will be away from the traditional laissez-faire capitalism, with the competitive system considerably modified.

Safety Work in The Metals Industry

Safety work in the metals industry will be discussed at several sessions by delegates to the twenty-second annual Safety congress and exposition to be held at the Stevens hotel, Chicago, Oct. 2 to 6. Robert L. Schmitt, Louisville Car Wheel & Railway Supply Co., will be general chairman of these sessions while W. H. Darr, Bethlehem Steel Co., will serve as secretary.

Importance of safety problems in the metals industry is indicated by recent reports to the National Safety council of the 1932 accident record of 108 industrial units of the foundry industry with an average of about 20,000 employes. Accident frequency rates of this group increased 6 per cent while the severity rates increased 14 per cent. Reports of 121 units in the steel industry, however, showed a slight drop in frequency from the 1931 rate and a 21 per cent decrease in severity. Since 1926 the severity rate has declined about 37 per cent.

Included among the various speakers at the sessions are: F. M. Gillies, assistant general superintendent, Indiana Harbor plant, Inland Steel Co.; W. D. Speight, safety director, Keystone Steel & Wire Co., Peoria, Ill.; John A. Oartel, chief of safety bureau, Carnegie Steel Co., Pittsburgh; and T. H. McKenney, supervisor of labor and safety, Illinois Steel Co., Chicago.

ADVERTISING PAGES REMOVED

Casting Beryllium-Copper Alloys

(*Concluded from Page* 21)

its maximum softness, maximum elongation and minimum tensile strength. This treatment, readily recognized as the solid solution treatment, is essential and preliminary to the precipitation hardening treatment described later. It should in all cases be applied before machining. For a 2.5 per cent beryllium-copper alloy, the brinell hardness of the quenched product is about 100. Such castings can be readily machined.

A feature of the beryllium-copper alloys, or the beryllium bronzes, is their susceptibility to a precipitation hardening treatment, which greatly enhances their properties and value as engineering materials. This treatment is applied to the annealed or solid solution beryllium-copper castings. Recommended practice is heating at 525 to 575 degrees Fahr. and no higher for varying periods of time so as to insure complete precipitation.

Recommend 3-Hour Period

To obtain the expected strengths, hardnesses and wear-resisting qualities from this special treatment, for castings containing 2 per cent or over of beryllium the heating period is recommended as 3 hours. There is a progressive increase in electric conductivity between a 3-hour and a 24-hour treatment, with a maximum obtained from the 24-hour treatment. For castings containing 1.25 to 2 per cent beryllium a 5-hour treatment is recommended to insure desired characteristics. Further investigation may somewhat alter these recommendations.

A special procedure is suggested, by the corporation producing the alloy for castings of thin section or complicated shape, because there is the possibility of some distortion taking place due to the weight of the casting pulling itself out of shape. To overcome this possible distortion, the following heat-treating sequence is suggested:

1. Heat in as nonoxidizing an atmosphere as possible at 1475 to 1500 degrees Fahr. (maximum) for 2 hours. Cool in air (normalizing).
2. Reheat, properly supported, and quench in water.
3. Rough machine, i.e., leave enough material for a safe finishing grind.
4. Reheat, properly supported in a form, and requench.
5. Precipitation harden on the form.
6. Wet grind to a finish.

This practice may be varied, two steps (Nos. 2 and 5) that are essential being always included. Step No. 3 may be omitted, leaving all machining until after precipitation hardening, employing Nos. 1, 2, 4 and 5, or at least steps Nos. 2 and 5. Any grinding in the hardened state should be done wet. Machining can be accomplished with any good grade of high-speed steel.

If pickling is found necessary, a 5 to 7 per cent solution of nitric acid, a 10 per cent solution of sulphuric acid, or a 10 per cent solution of nitre cake may be used. This should be carried out one step prior to the last heat treatment, which will of course, eliminate any occluded hydrogen caused by pickling.

The alloy which has received the most attention thus far and which has been found to be best suited for certain castings is the one containing about 2.50 per cent beryllium. In the precipitation hardened condition (after 3 hours heating at 575 degrees Fahr.) the properties as given by the alloy producer are as follows:

Tensile strength, lbs. per sq. in.	110,000 to 120,000
Yield point, lbs. per sq. in.	85,000 to 90,000
Elongation in 2 in., per cent	0.0
Reduction of area, per cent	1.0
Brinell hardness	375 to 400
Electrical conductivity	32 to 35 per cent standard annealed copper.
Thermal conductivity	Approx. same, relative to copper, as electrical conductivity

This phase of the casting development has not been thoroughly investigated, but a number of tests have been made. Table I gives a few of these tests for alloys of different percentages, in "as cast," annealed and precipitation hardened states. All tests were made by the Chase Copper & Brass Co., Waterbury, Conn., the Bridgeport Brass Co., Bridgeport, Conn., and the American Manganese Bronze Co., Holmesburg, Pa. Variations in heat treatment and in contained beryllium will alter these results.

Compared with steel, phosphor bronze and other high-strength materials, the electrical conductivity of beryllium-copper alloys is reported high. In general, the highest conductivity is reached at a beryllium percentage of around 2 per cent and a precipitation hardening period of 48 hours. In further reference to the deoxidizing effect of beryllium on copper castings, it has been ascertained that whereas, for example, 0.02 per cent phosphorus introduced into copper castings results in an electrical conductivity of 44, only 0.01 per cent beryllium imparts an electrical conductivity of 53. Conductivities as high as 56 are obtainable by the use of 0.02 to 0.03 per cent beryllium. Some thermal conductivity tests have been made by a reliable laboratory, but further data are necessary for drawing satisfactory conclusions.

Result of Recent Tests

Some hardness tests of cast 1-inch rods of two different beryllium-copper alloys have been made recently by the Martin Forge Co., Brooklyn, N. Y., which are of some interest. The two alloys contained 1.85 per cent and 2.35 per cent beryllium, respectively. They were heat treated in molten salts at 525 to 575 degrees Fahr., respectively, for various periods as indicated in Table II, which gives details of the resulting hardness in brinell and rockwell numbers.

These results, which are not conclusive but are indicative of the trend, show that at 525 degrees Fahr. the maximum hardness is reached at about the 3-hour heating period for both analyses. For the 575-degree heating period, the highest hardness seems to be reached at about the 2½-hour heating period. Variations in the progressive increases in hardness may be due to alterations in structure. This phase of the entire subject merits careful study.

Wear tests were made an on Amsler machine and conducted according to the latest aproved practice. As a standard for comparison, a 0.43 per cent carbon steel was used, oil quenched from 1600 degrees Fahr. and tempered at 1100 degrees Fahr. The resulting hardness was about C22 rockwell. Cast disks of the alloy, containing 2.35 to 2.46 per cent beryllium, in six disks were used. The tests were made to determine

Heat Treating

PROGRESS made thus far in the casting of beryllium-copper castings is reported in this article, which is from a paper presented at the recent Chicago meeting of the American Foundrymen's association. The author discusses the master alloy which is used as a raw material for introducing beryllium into the alloy. With this master alloy as a raw material base, varying percentages of beryllium may be introduced into copper with about 1.50 to 2.50 per cent beryllium in the prevailing alloyed products. A feature of the beryllium-copper alloys or beryllium bronzes, is their susceptibility to a precipitation hardening treatment, which adds to their value as engineering materials. Numerous uses of the alloys also are discussed.

the effects of age or precipitation hardening on the wear-resistance properties of the alloys.

Hardness of the unheated or "as cast" disks was B73.1 to B85 on the rockwell machine. After heating to 1479 degrees Fahr., holding for ½ hour, quenching in water, then heating to 600 degrees Fahr. and holding for 3 hours, followed by air cooling, the hardness of two specimens was rockwell C41.3 and C43.3. Heating to 575 degrees Fahr. and holding for 24 hours, followed by normalizing, resulted in a lower hardness of C31.4 and C30.1.

Results of tests indicated that the beryllium bronze as cast, with a rockwell hardness of B85, lost 0.0084 grams per 10,000 revolutions in the Amsler machine. The steel specimen had a wear loss of 0.0168 grams. After the 3-hour precipitation hardening treatment, the disk having a hardness of rockwell C43.3 lost only 0.0003 grams, as compared with 0.0001 grams for the standard steel. Specimens subjected to the 24-hour precipitations hardening treatment, which naturally had a lower rockwell hardness, showed considerably larger loss from wear.

Development Is Recent

Development of beryllium-copper castings is so comparatively recent that applications for them have not been extensively explored. Doubtless, because of the many possible properties which can be developed by judicious heat treatment, many uses will come to light as the industry develops. Several however, have been found which are of interest. A few of these are briefly discussed in the following paragraphs.

In the aviation field an extremely interesting application of a bearing sleeve of 2.50 per cent beryllium-copper casting has been approved and adopted. New adjustable pitch propellers for airplanes have been perfected and now are being introduced which promise to change flying methods and hazards radically. These adjustable pitch propellers require an intermediate sleeve between the shaft and the blade to provide a satisfactory bearing base to take care of the relative motion between the two parts. The problem was solved by the use of cast beryllium-copper. In the hardened condition, this alloy is extremely hard, providing at the same time a metal which possesses excellent bearing characteristics.

Another use of beryllium bronze, which has recently been demonstrated is for cast propellers of racing boats. A 3-blade propeller of 2.5 per cent beryllium-copper, weighing about 18 pounds, recently was cast by the Columbian Bronze Co., Freeport, N. Y. One reason for trying this was that it was possible to decrease the thickness 25 per cent from the manganese propeller which was displaced. There was no consequent loss in strength or rigidity. The propeller, after thorough tests, was found to increase the speed 2 seconds per half mile over any propeller previously used. It is being installed in one of the Gold Cup racing boats.

It has been found that cams of beryllium bronze have some advantageous properties when installed in certain machines. A few of these have been cast having a diameter of 12 inches with a 7-inch face, and a large cam manufacturer has been using them with success. For gears and pinions, particularly worm gears, this alloy is claimed to be particularly suitable. Some gears have been installed on motor buses for a certain company, but data on the results are not yet available.

In the field of corrosion resistance, several applications of fabricated beryllium-copper alloys indicate promising possibilities for castings in the petroleum industry. In two installations, handling extremely corrosive and abrasive sulphur compounds, the performance of the alloy is materially superior to any of the many alloys previously tried.

Some other miscellaneous applications which are under way include worm driving gears for jaw riveting machines, chilled rifle bar nuts for rock drills, propeller hub cones for airplanes, and valve parts and centrifugal pump parts for line valves.

Shows Contribution Of Alloys to Progress

Progress in industry and transportation brought about through the use of alloy irons and steels is shown at the Century of Progress, Chicago, in the exhibit of the Union Carbide & Carbon Corp. A pictorial representation of the age of alloys is engraved on special plate glass and colored. The corporation also cooperated in the construction of the basic science exhibit. "The Story of the Electric Furnace" demonstrating the place of the arc, resistance and induction type furnaces in modern scientific progress.

A. S. M. E. Nominates Officers at Chicago

Nominations for officers of the American Society of Mechanical Engineers for 1934 were announced at the recent Chicago meeting as follows: President, Paul Doty, Minnesota state board of registration, St. Paul; vice presidents, H. L. Doolittle, Southern California Edison Co., Los Angeles, William L. Batts, SKF Industries Inc., New York, Ely C. Hutchinson, Edge Moor Iron Co., Edge Moor, Del., and Elliott H. Whitlock, Cleveland; managers, James M. Todd, New Orleans, Ernest L. Ohle, Washington university, St. Louis, and James A. Hall, Brown university, Providence, R. I.

Election will be held by a letter ballot of the entire membership, closing on Sept. 26, 1933.

Book Review

The National Industrial Recovery Act, by Benjamin S. Kirch, in collaboration with Harold Roland Shapiro, cloth, 156 pages 4½ x 7¼ inches, published by the Central Book Co. and supplied by THE FOUNDRY, Cleveland, for $2.50 and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

Executives of trade associations and individual companies should be interested in this volume containing a discussion of legal phases of the industrial control provisions contained in the National Industrial Recovery act. The text takes up the necessity for the recovery act, and an explanation of the act itself.

This is followed by a discussion of the extent to which trade associations have been strengthened through the liberalization of the antirecovery laws by Nira, and how recalcitrant minorities in the industry can be controlled through self-regulating codes of fair competition, or under compulsion of presidential codes and licenses. Under the heading "Provisions Applicable to Labor," the author indicates the extent to which labor's grievances under the Sherman act have been overcome under Nira, and the degree of participation intended for labor in the preparation of codes of fair practices dealing with wages, hours and fair standards. The author also has included some personal observations on the implications of the law. An appendix presents the industrial control provisions of the act.

Measures Rate Of Flow of Air in Line

The equipment described on page 37 of the July issue of THE FOUNDRY in the section devoted to "Viewing Foundry Developments at Short Range" is used to measure the rate of flow in the air line which connects the blower with the cupola instead of to measure the pressure in the wind box, as reported. Information for the description was secured from *La Fonte*, a quarterly bulletin published by the French Centre of Foundry Research.

United States civil service commission has announced competitive examinations for senior engineer, engineer, and two associate engineers. Applications for the positions must be on file with the commission at Washington not later than Sept. 28.

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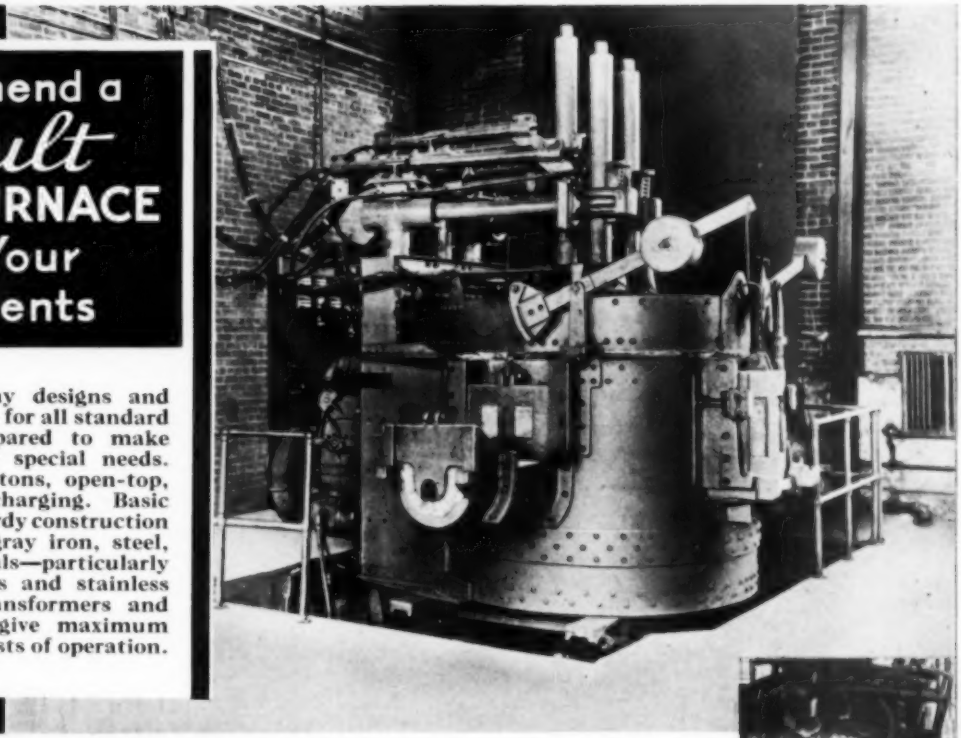

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CRUCIBLES

"Every Refractory For The Foundry"

Cast Steel in Europe and America

(*Concluded from page* 23)

Captain Shane states, "The basic process is the one usually employed because of the lack of pig low in sulphur and phosphorus. In large plants there may be one acid lined furnace to produce special steel," and again, "—in the case of open hearth plants, an occasional acid lined electric furnace is used for special purposes." Also "Near Liege, Belgium, they state that frequently when they fail with the siemens martin furnace, they have no difficulty with the arc furnace."

Mr. Batty would be interested to know whether the arc furnace operates on the same process, acid or basic, at this plant. It is reasonable to believe that either the basic or acid electric process will produce steel superior to the product of a basic open-hearth furnace operating on low grade material. The acid electric process definitely demands material of a purer type—lower in sulphur and phosphorus—than that which may be used in the basic process. All this makes the case against the American steel founder look blacker, for it must be admitted he has adequate supplies of suitable *pure* materials available for acid practice either in the open-hearth or electric furnaces.

Temperature Related to Fluidity

Touching for a moment on the influence of fluidity of steel in its relation to the production of sound castings, Mr. Batty claims we must concede that while temperature does not positively predicate fluidity, it is related closely. This factor must be borne in mind when devising the gating and heading system for large or complicated castings. The conception of a casting solidifying *all at once* is fundamentally wrong and in any case could not be achieved.

The gating system must be devised to give a temperature gradient in both mold and metal to promote a proper direction or progress of solidification. Proper gating and heading procedure is considered an art by some foundrymen. By others it is considered a science, mutable to the application of intelligence and endeavor. Therefore, Mr. Batty believes that if the European foundrymen have buttressed their artisans with scientists to the extent proclaimed by Captain Shane, it is logical that their castings will be better than those produced in foundries operating on the assumption that the production of castings is an art and not a science. Also it is logical to believe that castings produced on such system will cost more than those produced without the added expense of the scientifically trained foundry engineer and metallurgist.

Quoted details in Captain Shane's paper of equipment, materials and processes in melting, molding, coremaking and heat treatment do not differ essentially from those in American foundries with the possible exception of speed and the use of *chamotte* according to Mr. Batty. A material known as *molder's compo* and used extensively in British steel foundries resembles *chamotte* to a considerable extent and is produced by grinding clay crucibles and fire bricks to a suitable size. Bonded with fire clay this material is used in the production of heavy castings where the molds must withstand the ferrostatic pressure of the liquid metal. A highly refractory material also is required to withstand the thermal attack of the metal, particularly in the gate region.

Practice Is Duplicated

A careful scrutiny of Captain Shane's paper indicates to Mr. Batty that whatever favorable features were observed in European practice can be duplicated in American foundries. Possibly the same intensity of scientific application noted in one European foundry would not be found in any one foundry in this country, but without doubt the leaven is working and the United States navy can obtain in this country castings of a quality equal to any obtainable elsewhere.

Some steel founders, Mr. Batty explained, deplore what they consider the frigid and costive mentality of some users of steel castings. They insist upon certain physical properties which do not appear justifiable when the actual service conditions of the component are considered. More and more cooperation between designer, tehnician and artisan is to be desired and a more close approximation of the service conditions of each type of casting should be arrived at that the best possible material be evolved at the lowest practical price.

He is quite in accord with Captain Shane's strong condemnation of the practice of cleaning steel castings by the pickling process even though the process is favored by the British Admiralty.

Mr. Batty concludes his paper with the observation that there is no strange alchemy of mind which leads European foundrymen to correct conclusions and there is no ineradicable dumbness in American foundrymen. The situation resolves itself into a *quid pro quo* in the terms of a straight forward commercial transaction where the laborer is worthy of his hire. Results can be obtained, but results must be paid for. American steel foundrymen under indictment, welcome honest, sincere criticism and hopefully envision co-operation with engineers, designers and users of steel castings.

This is the second of a series of articles dealing with the discussion which followed the presentation of a paper on steel castings technique in Europe. Others in the series will appear in early issues of THE FOUNDRY.
—THE EDITOR.

Studies Government Competition with Industry

Factors relating to government competition with privately owned foundries are discussed in a recently published report of the special committee appointed to investigate government competition with private industry by the House of Representatives. While the committee made no recommendation with regard to foundries, several conclusions will have application to that industry.

After hearing a great deal of evidence with reference to the activities of arsenals and navy yards, the committee decided that it did not feel justified in making specific recommendations with reference to curtailing or continuing their various activities. The committee recommended that a study be made of all cost accounting factors in government work to determine the actual cost to the government. After such a study has been made, the committee then would be inclined to favor the award to private industry of such activities of arsenals and navy yards as are not incompatible with national defense.

The committee also recommended that the heads of the various government bureaus be directed to order an immediate investigation of any activities competitive with private business carried on by their respective departments, and report to Congress their conclusions as to their effectiveness from the standpoint of cost, economy and public policy, to the end that there may be a liquidation of all such bureaus, subdivisions or agencies under their control competing with private trade, commerce, finance, industry of professions, the operations of which are not of interest to the general public.

Cutting Practice

Continuous demonstrations and motion pictures of oxy-acetylene welding and cutting are given in a sunken amphitheater located in the exhibit of the Union Carbide & Carbon Corp. Hall of Science at the Chicago Fair. The spectator looks down into a huge bowl flooded with a light from concealed sources, and while watching, an opening appears in the base of the bowl and a workman is shown using a welding and cutting outfit. The lights then fade out, the demonstrator disappears and a short motion picture is shown on the screen.

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European Foundry Practice

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Varying Sections

Molybdenum for Producing Uniform Castings of Varying Thicknesses, experimental work by Dipl. Ing. Pohl, metallurgical director, Gesellschaft fur Elektrometallurgie, Berlin, Germany.

An important effect of molybdenum in castings is its power to distribute uniformly the carbides and graphite, independently of the cooling velocity in various sections. Disadvantage of rapid cooling in thin sections and slow cooling in adjacent thick sections can be avoided by the use of molybdenum. Uniform distribution of combined and graphitic carbons, regardless of thickness of section, is evidenced by the uniform brinell hardness in sections of various thicknesses.

The following tests were made to bring out this effect. A heat was made of the following analysis: Total carbon, 3.37 per cent; silicon, 1.61 per cent; manganese, 0.45 per cent; phosphorus, 0.85 per cent; sulphur, 0.10 per cent; molybdenum, 0.68 per cent. The heat was cast into castings having wall thicknesses of 0.39, 0.79, 1.18 and 1.57 inches; combined carbon of 0.85, 0.85, 0.86 and 0.84 per cent; and brinell of 204, 196, 200, and 198 respectively.

A wheel 19.7 inches in diameter with a solid hub 3.1 inches in diameter and 4.7 inches high and with rim thicknesses of 0.79, 1.18, 1.57 and 2.36 inches respectively, was cast. The cupola iron used for the wheels had the following analysis: Carbon, 3.30; silicon, 1.14; manganese, 0.87; phosphorus, 0.23 and sulphur, 0.13. One wheel, marked *A* was poured from that iron, a second marked *B* was poured with the same iron alloyed with 0.32 per cent molybdenum, and a third, *C* of the same iron contained 0.64 per cent molybdenum. *A* iron had a bending strength of 62,300 pounds per square inch, a deflection of 0.433 inches and a tensile strength of 41,700 pounds per square inch; *B* iron a bending strength of 76,100 pounds per square inch, a deflection of 0.512 inches and a tensile strength of 44,700 pounds per square inch; *C* iron a bending strength of 81,100 pounds per square inch, a deflection of 0.551 inches and a tensile strength of 48,800 pounds per square inch.

The wheels were cut up, the pieces milled, polished and tested. Brinell hardness at the various thicknesses for the three wheels were as follows: 0.75 inch, *A*-178, *B*-185 and *C*-193; 1.18 inch, 171, 185 and 193; 1.57 inch, 166, 185, 190; 2.36 inch, 169, 185, 193; hub, 159, 180, 190, respectively. In *A* the variation in brinell hardness between the thin section and the hub is 18 points, in *B* only 5 points and in *C* 3 points.

Coloring Aluminum

Anodic Treatment and Dyeing of Aluminum Castings, by N. D. Pullen, paper presented at 1933 annual conference of Institute of British Foundrymen.

Processes can be divided into three groups, not only as to the electrolyte used but also as to their country of origin, as follows: Chromic-acid group, British; sulphuric-acid group, American; oxalic-acid group, German. The chromic acid films are more or less opaque and when produced on pure metal are of a pearly-gray color. They are soft when first formed, but resistance to abrasion shows a marked increase with age. Sulphuric-acid films are transparent and practically colorless and when freshly formed are harder than those produced with chromic acid. Films produced from oxalic acid are more or less transparent but have a distinct yellow tinge which varies in intensity, depending upon the particular manner in which the film was produced. In the same way the hardness varies from extremely hard, brittle films to soft and comparatively flexible ones.

For the treatment of castings it rarely happens that more than two types of film are required, that is to say resistance to corrosion combined with good dyeing properties and, or resistance to abrasion. Flexibility need not be considered, as, unlike a piece of sheet or wire, the material is not required to withstand deformation.

Economic Control

The Economic Control of the Cupola (La Conduite Economique du Cubilot), by E. V. Ronceray. *La Revue de Fonderie Moderne*, Paris, June 10, 1933.

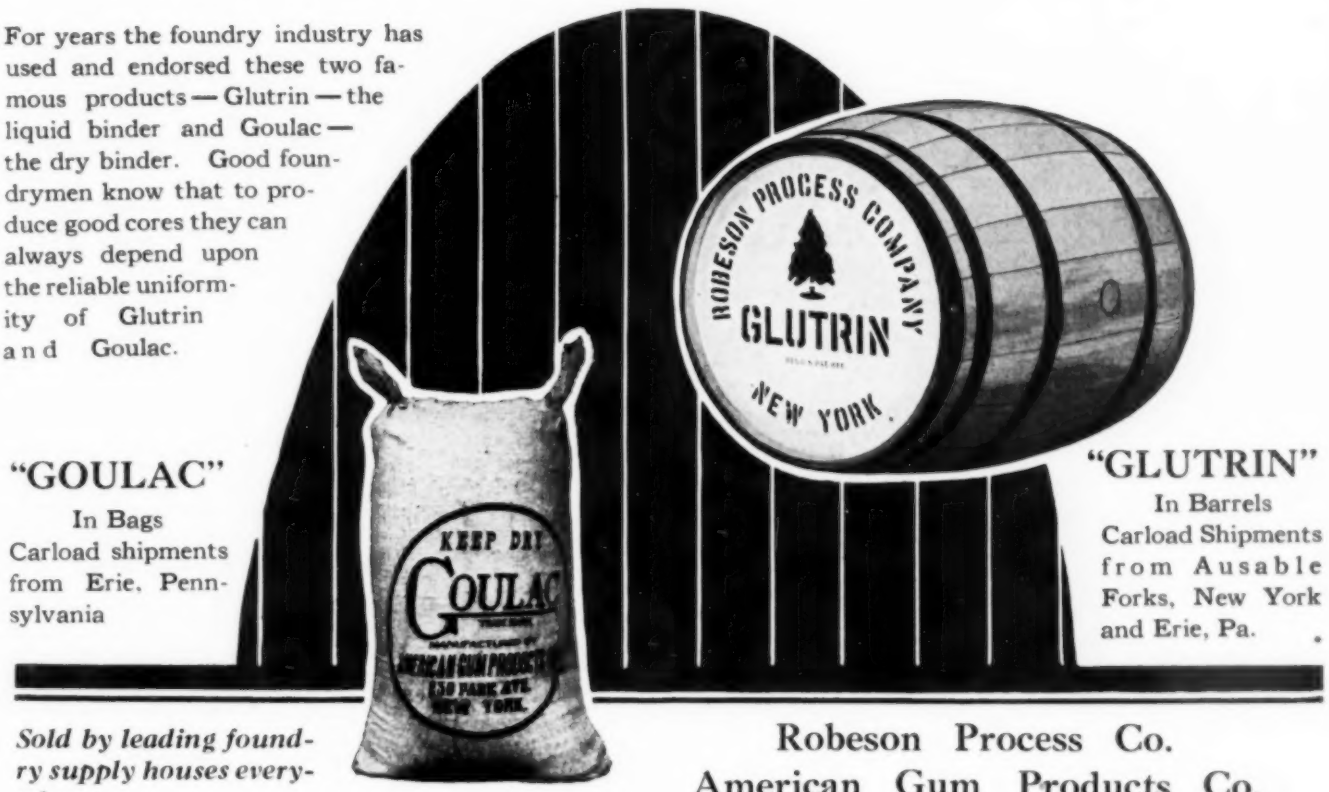
Coke should be charged in pieces of uniform size; this also helps in getting the charges to drop through the shaft in practically horizontal layers, which has the important result of obtaining isothermic zones throughout the cupola. It also is necessary that the air blown through the tuyeres should be distributed regularly.

Considerable flame at the top of the cupola indicates an excess of carbon-monoxide and, therefore, that the coke has not been efficiently used. When a cupola is properly controlled, only a small amount of flame should be seen. It is better that there should be a little, as it is best to have a slight excess of carbon-monoxide to avoid the risk of oxidizing the metal. Reviewing the use of cupolas in the past, the author points out that as far back as 1854 cupolas were operated with a coke consumption of from 6 to 9 per cent, and such a low consumption is not exceeded today.

Reviewing experiments and developments made in America and Europe since 1884, it would seem that: (1) there should be no necessity to charge more than from 7.5 to 8 per cent of coke per melt; (2) there is no advantage in blowing more air into the cupola than is required for normal production; (3) oxidation in the cupola is generally much less than is usually thought to be the case; (4) there is relatively little oxidation in the cupola outside the immediate proximity of the tuyeres and the walls; (5) the combustion cone has shown itself to be that determined by the tests of the bureau of mines of Pittsburgh; (6) the consumption of coke can be brought down to about 6.3 per cent without the temperature of the iron dropping to less than 1410 to 1450 degrees Cent; (7) there is no difficulty in obtaining a thermic efficiency in the cupola of 45 to 50 per cent. The author stresses the fact that all these results can be obtained with proper control.

DON'T ACCEPT A SUBSTITUTE!

For years the foundry industry has used and endorsed these two famous products — Glutrin — the liquid binder and Goulac — the dry binder. Good foundrymen know that to produce good cores they can always depend upon the reliable uniformity of Glutrin and Goulac.



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In Bags
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Sold by leading foundry supply houses everywhere.

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Every saving counts now when costs must be cut to meet conditions. Why let the other fellow with lower cleaning costs have the advantage over you in figuring selling prices?

One ton of Globe shot in most cases will convince you that shot-blasting is the low-cost way to clean castings, whether grey iron, malleable or steel.

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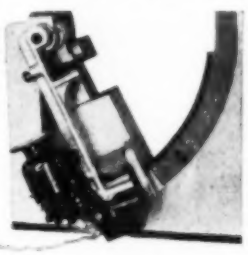
Sand Control

means

Foundry Recovery



Universal Sand Strength Machine Type C. P.

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Sand control saves by protecting this large portion of your cost.

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The Type C. P. is used world wide. The Universal Sand Strength Machine, type C. P. is a complete bond strength machine for cores or sand, Green or Dry.

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Obituary

WILLIAM D. TYNES, president, Hardie-Tynes Mfg. Co., Birmingham, Ala., and for the past 35 years actively engaged in the manufacturing business in Birmingham, died Aug. 19. Mr. Tynes was born in Itawamba county, Mississippi, Sept. 11, 1863, and was educated in the local schools and at Fulton college and Cooper institute. In 1897 he went to Birmingham where he became associated with the late William Hardie in the foundry and machine shop industry. They operated the Hardie-Tynes Foundry & Machine Co. on First avenue until the plant was destroyed by fire in 1901, when the present plant at Eighth avenue, north and Twenty-Eighth street was constructed. Mr. Tynes was the directing head of the concern since the death of Mr. Hardie in 1916.

John W. Waters, 73, president, National Radiator Corp., Johnstown, Pa., died recently at Washington.

F. F. Woods, representative of Roots-Connersville-Wilbraham, Connersville, Ind., in the Pittsburgh territory, died at his home recently. Before becoming associated with the Roots-Connersville-Wilbraham organization, Mr. Woods represented the Hayton Pump & Blower Co., Appleton, Wis.

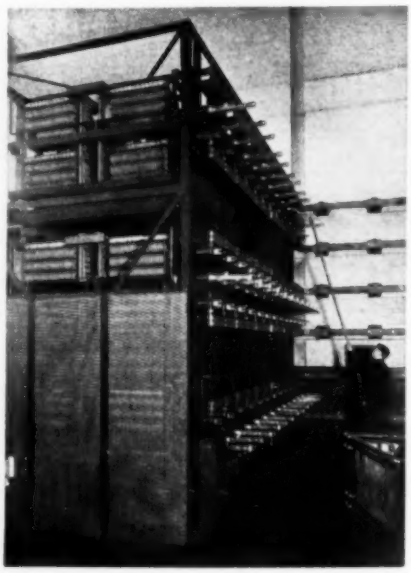
Otis Jay Cessna, 59, salesman for the Albion Malleable Iron Co., Albion, Mich., died recently. Mr. Cessna had been connected with the Albion Malleable Iron Co. and the former Advance Thresher Co., Battle Creek, Mich., for nearly 40 years, becoming connected with the former company in 1914. He also served on the Albion City Council in 1921.

Joseph Doty Oliver, 83, president, Oliver Chilled Plow Works, South Bend, Ind., and chairman of the Oliver Farm Equipment Co., died recently at his home in South Bend. Mr. Oliver, the son of James Oliver, started his career as an office boy in the South Bend Iron Works in 1867. Some years later the iron works became the Oliver Chilled Plow Works, and in 1908, Mr. Oliver assumed management of the Oliver Chilled Plow Works on the death of his father. He served as trustee of Purdue university, Lafayette, Ind., for 18 years.

Charles Dufour, 69, former chairman of the French foundry employers' federation died recently. M. Dufour had large interests in both blast furnace and light castings industries. He was chevalier of the Legion of Honor since 1911, and was prominent in war work and foundry reconstruction following the war. M. Dufour was the leading spirit in the organization of the international foundry exhibition held in Paris in 1932. His enthusiasm and personal activity contributed much to the advance of apprentice training through his association with the Paris Foundry High School, and the French cast iron research association.

Uses Alloy Grids For Large Resistor Unit

Seventy two special nickel-alloy resistor units are an important part of a new 60,000 kilovolt-ampere testing laboratory; one of the world's largest, which has been built by the Westinghouse Electric & Mfg. Co., East Pittsburgh Pa. By proper manipulation of series-parallel switches the resistance of the bank can be made anything from 6.25 to 0.0433 ohms. The grids are cast of a special nickel alloy.



Many castings are used in the resistor unit

Book Review

The Primer of Inflation, by Earl Sparling, cloth, 133 pages 5 x 7½ inches, published by the John Day Co., and supplied by THE FOUNDRY, Cleveland, for $1.50, and in Europe by the Penton Publishing Co. Ltd., Caxton House, Westminster, London.

The author of this small but interesting volume has endeavored to discuss inflation and the effect it will have upon the various classes of our American civilization. He believes that the shrewd will begin creating debts just as soon as inflation begins, and that by borrowing at one level and paying off at a lower level as long as inflation lasts, will profit enormously. In this, the rich will find it easy, and the wage earner, or forgotten man, will find in inflation only trouble and pain and a skimpy table.

Credit inflation has been the vehicle on which many men have ridden to riches. To secure a better understanding of credit inflation, the author discusses things covered by the word money, and then explains the mechanism and results of such inflation. He then discusses the origin of modern banking, at least as it was practiced during recent years.

The remainder of the discussion deals with the three periods of currency inflation which this country previously has experienced, and the experience of Germany in the post war period which may be held as a warning of what may happen if inflation in a dynamic modern nation gets out of hand. The author feels that there are explosive potentialities in inflation for everybody, from the large manufacturer to the small business man and every worker.

Bond Safety Tread Abrasive with Rubber

A new type of safety tread composed of aluminum oxide aggregate securely bonded in a reinforced base of hard tough rubber, has been developed by the Norton Co., Worcester, Mass. The aggregate is produced by taking fine sizes of aluminum oxide and mixing it with special bonding clays. The mixture is pressed into blocks and is vitrified in kilns. The blocks then are crushed and screened to the desired sizes and the resulting aggregate consists of the minute grains of abrasive held together by the hard, glass-like vitreous bond. The aggregate is irregular, angular and slightly porous so that it bonds securely with the rubber.

The tread is supplied in units of various lengths and widths and can be placed directly over wood, steel, concrete or stone steps. The entire length of the tread may be covered with the unit, or it may be applied as a nosing for 6 inches or more on the outer edge of the tread. If the latter procedure is followed the area back of the safety tread may be covered with linoleum, rubber tiling, wood, etc.

Malleable Club Meets

The Malleable club of the Milwaukee district was entertained at an outing at the Delavan country club, Delavan Lake, Wis., on Saturday, July 29, through the courtesy of Omar Smith, Smith Oil & Refining Co., Rockford, Ill. Prof. Scott Mackay, university of Wisconsin, is president of the club.

John O. Weber, 122 Main street, Louisville, Ky., has been appointed representative of the Coppus Engineering Corp., Worcester, Mass.

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Made by an original and unique process, MOGUL is a perfect green sand bond for facings. It produces maximum strength but simultaneously gives natural vents in the sand.

Our experienced and practical foundrymen can prove to your satisfaction MOGUL is all we claim for it.

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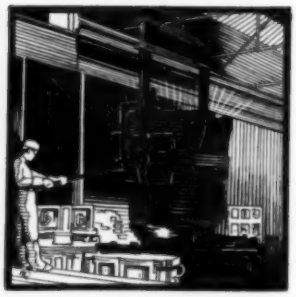
*2

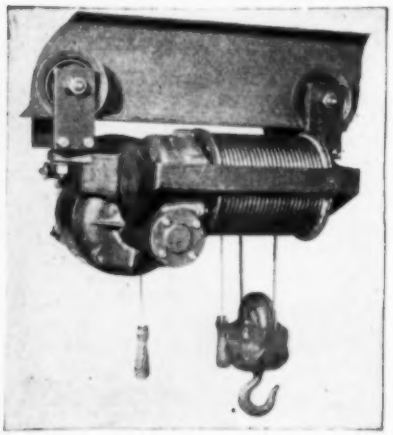
New Equipment



For Foundries

Electric Hoist Has Single Worm Drive

Electro Lift Inc., 30 Church street, New York, has developed a junior model overhead electric hoist with a capacity of 500 pounds. This unit, shown in the accompanying illustration, may be equipped with top hook



The electric hoist has a capacity of 500 pounds

for rigid overhead suspension or it may be supplied with a plain trolley for use on any monorail track. The junior model as well as the standard models with capacities of ½ to 5 tons have a single worm drive.

All parts are totally enclosed, gears and antifriction bearings operating in a bath of grease. Hoists are balanced at all loads, have steel suspension, and the motor brake and electric limit switch provide an automatic and positive stop to prevent overtravel of the hook at the top of the lift. Either rope control or push-button control may be furnished.

Attaches Cloth To Arrester Frames

A new tacker designed for attaching cloth in screen frames of dust arresters, and which operates automatically by compression, has been introduced by the A. L. Hansen Mfg. Co., 5039 Ravenswood avenue, Chicago. A slight squeeze of the hand on the operating lever causes energy to be built up and then suddenly released with trip hammer effect, driving the fastener staple firmly into the surface. It is claimed that the driving force is sufficient to drive a staple into hard wood with ease. The unit may be operated with one hand, thus leaving one hand free to hold or pull the work in place. The tacker weighs about 1½ pounds, and claimed to be designed to prevent possibility of jamming or clogging.

Accuracy Features New Indicating Gage

Foxboro Co., Foxboro, Mass., has developed an indicating gage designed to use a full length Bourdon spring, thus resulting in a reduction in movement multiplication and an increase in accuracy. It is claimed that the gage is accurate to within 1 per cent of its total scale.

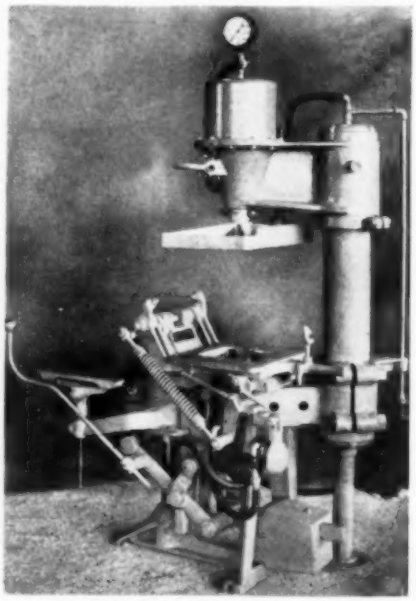
This model indicating gage is supplied in a drawn brass case and ring with buffed nickel finish. Buffed brass or chromium finish also may be supplied. The connection may be either top, bottom, left or right side. Dials may be secured with black background and white figures or white background and black figures. Any range from 0-15 pounds per square inch to 0-300 pounds per square inch, as well as 0-30 inches mercury vacuum can be supplied.

Vibrator Has Air Floating Piston

New-Son Tool & Mfg. Co., Milford, Conn., has introduced a line of vibrators which operate without springs. The unit has an air floating piston which it is claimed means a live weight piston and a reduction in wear. The exhaust is guarded so that there is no possibility of sand entering the vibrator mechanism. The units are made in sizes ranging from ½ to 3 inches.

Combines Jar Rollover and Squeezer

Tabor Mfg. Co., 6225 Tacony Street, Philadelphia, recently has introduced a new unit which is a combination of a jar rollover machine and a post squeezer. The rollover



Molding machine combines jar rollover and squeezing actions

member has a table 14 x 16 inches and will handle flasks up to 14 x 30 inches. It is equipped with a hand operated flask clamp and a mechanism of simple and substantial design for leveling the molds preparatory to drawing the pattern. All wearing parts have bronze bushings. The pattern draw is 8 inches and the draw shaft is equipped with roller bearings to permit accurate draw regardless of wear.

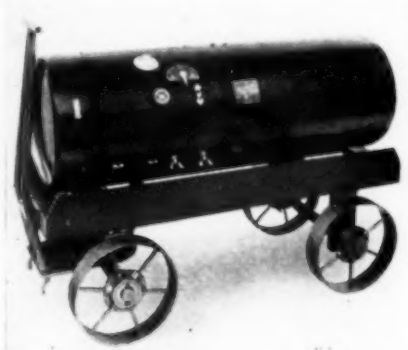
The jarring operation is controlled by a knee pad conveniently located. The squeezing head, carrying the overhead squeeze cylinder, is supported on a substantial post which, while attached to the jarring member, is supported entirely by a flanged base resting directly on the floor. The machine is equipped with vibrator, blow valve and pressure gage.

Applies Furnace Lining Pneumatically

A machine which applies crushed fire brick, fire clay and other refractory materials pneumatically in lining and repairing furnaces, ladles, soaking pits, cupolas and other equipment, recently has been introduced by the Gunitor Co., 1227 West Beardsley avenue, Elkhart, Ind. A number of types of machines are included in the line of equipment developed for that purpose. One model is operated with electric motors and has electrical remote control, thus enabling the machine to be charged by one man and started or stopped from remote position. Other models include a combination unit with gasoline engine, air compressor, water pump and gun unit mounted on a steel towing chassis with solid rubber tires. Another type includes a pug mixer for combining ingredients and elevating motor for charging hoppers or chambers of the unit. Capacities of material range from 40 cubic feet an hour in the small unit to 250 cubic feet an hour in the larger sizes.

Steel Enclosure Features New Welder

USL Battery Corp., Niagara Falls, N. Y., recently introduced the arc welder shown in the accompanying illustration. New design and performance are emphasized by the maker as outstanding features of the welder. The complete mechanism,



The complete mechanism is contained in a heavy, sheet steel cylinder

including motor, generator, exciter, controlling devices, and all wiring, is enclosed in a heavy, sheet steel cylinder.

Specifications of the machine follow: Generator, four main poles and four interpoles, ball bearings used throughout; motor, standard, line-start induction; starter, magnetic push button with voltage and thermal overload protection; exciter, mounted on main generator shaft, integral construction; rating, 40 volts, exceed NEMA and U. S. Navy specifications, according to maker; welding range, 40 to 550 amperes; dimensions, 52 x 36 x 24 inches overall; weight, 1400 pounds.

Arc stability and instantaneous recovery contribute to faster welding in the hands of an expert and to usefulness in the hands of a beginner, according to the maker. Oscillograms and charts are presented by the maker supporting the claim of remarkable welding range and stability.

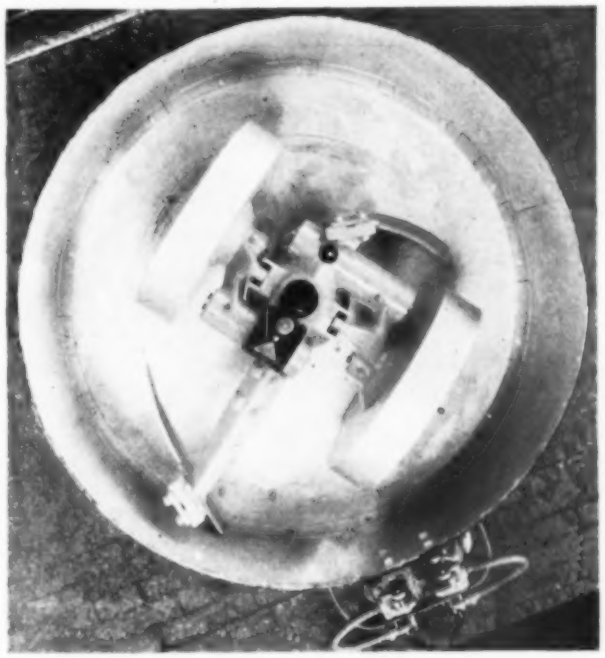
Builds Motorized Type Reduction Gears

Foote Bros. Gear & Machine Co., 5301 South Western boulevard, Chicago, has introduced a line of motorized reduction gears in sizes and types ranging from ½ to 150 horsepower capacity and ratios ranging from 2 to 1, up to 3600 to 1. Motor characteristics may be varied to suit the particular application including normal starting torque, high starting torque, high slip, adjustable speed and multispeed.

The line is divided into two divisions, the radiating worm gear type and the helical gear type. The worm gear line covers ratio changes from 4 to 1 to 60 to 1 single reduction style and up to 3600 to 1 in the double worm reduction type. The helical type is made in single and double and triple reduction ratios, providing a range of output speed from 4 to 850 revolutions per minute and horsepower capacities up to 150 horsepower. Efficiencies of the helical line are said to range as high as 98 per cent at low reduction ratios.

Mullers Offset To Increase Rubbing

National Engineering Co., 549 West Washington boulevard, Chicago, recently introduced a new model of sand mixing machine operating on the mulling principle which incorporates numerous improvements in design. A



Interior view of the mill showing the arrangement of plows and the offset on the mullers to increase the rubbing action

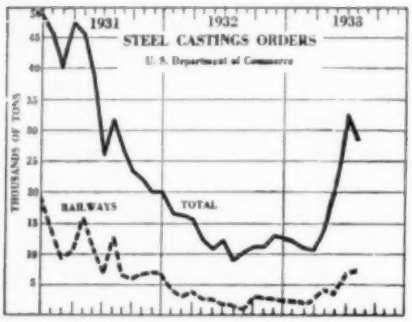
view of the interior of the mill illustrating the arrangement of mullers and plows is shown in the accompanying illustration.

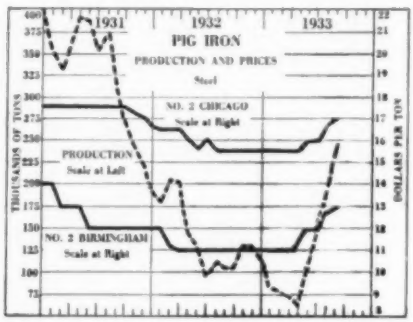
Antifriction bearings are provided on this machine on the vertical shaft and the mullers. The vertical shaft is operated in a bath of heavy lubricating oil, and the lubricating system has been simplified so that only six points need be lubricated. As shown in the illustration, the mullers are offset on each side of the center line of the machine to increase the mulling and rubbing action. Mullers are adjustable to prevent grinding of materials.

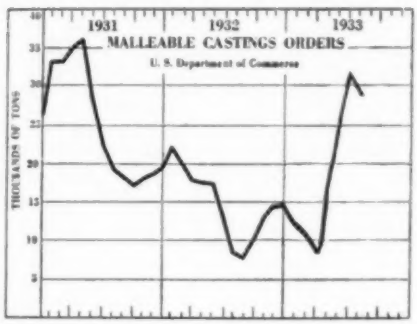
The outside plow beam is rigid and adjustment of the plows is simple. The height of the turret has been increased 2¼ inches. Crib fillet is provided to improve the efficiency of the plow action.

Motor Control

New lines incorporating special features have superseded all standard lines of synchronous motor control built by the General Electric Co., Schenectady, N. Y. Relays for automatically applying and removing field excitation and for protecting the stator and amortisseur windings under all operating conditions are included in this control equipment.







Foundry Activities

Reflect Industrial Trends

SMITH STEEL CASTING CO., Anderson, Ind., recently purchased plant No. 1 of the Lavelle Foundry Co., Anderson, from Linfield Myers, receiver for that company, after having leased the property for 3 years. K. Smith is president of the company and R. E. Dudley is vice president.

* * *

Southern Car & Mfg. Co., Birmingham, Ala., recently suffered a $12,000 fire loss to its core department.

* * *

Standard Foundry & Furnace Co., Pleasant street, DeKalb, Ill., reports an increase in business. F. S. Simms is manager.

* * *

Prescott Co., Menominee, Mich., has resumed operations after being idle since March. Curry S. Prescott is president.

* * *

Sprague Foundry & Mfg. Co., Council Bluffs, Iowa, has let a contract for a 1-story foundry, 76 x 104 feet. J. Katelman is manager.

* * *

Ferro Pipe & Foundry Co., Vineland, N. J., has been incorporated to manufacture iron pipe. Tuso & Stanger, Vineland, are correspondents.

* * *

James F. Powers Foundry Co., Elkton, Md., has been declared insolvent by the court and ordered to be dissolved.

* * *

Advance Aluminum Castings Corp., formerly the Supermaid Corp., 2742 West 36th place, Chicago, recently has increased production. Roy W. Wilson is president.

* * *

A. B. Stove Co., Battle Creek, Mich., his discontinued its foundry and is securing its castings from the Marshall Furnace Co., Marshall, Mich., a subsidiary company.

* * *

Sibley Machine & Foundry Corp., South Bend, Ind., has been incorporated to operate a foundry and machine shop by Bernard J. Voll and A. G. Graham.

* * *

Tulsa Stove & Foundry Co., Sand Springs, Okla., recently organized, has resumed production of gray iron castings and plans to establish a machine shop. Larry Hinz is general manager.

* * *

Nelli Art Bronze Foundry Inc., 2313 Garnett street, Los Angeles, will build a plant at 3426 Union Pacific avenue. Arthur W. Hawes, 1047 South Orange Grove avenue, is architect.

* * *

Atlas Brass Foundry Co., Columbus, O., has been incorporated with $225,000 capital and 250 shares no par value to operate a castings business, by C. C. Crabbe, Citizens Bank building, Columbus, O.

* * *

Saco-Lowell Shops, Biddeford, Maine, has awarded the contract for a small extension to its foundry. This will be a standard steel frame building, 30 x 138 feet, covered with corrugated asbestos.

* * *

Galesburg Furnace & Foundry Co., 557 South Cherry street, Galesburg, Ill., has been incorporated by J. B. McNeil, L. C. Struble and R. G. Callison, to manufacture furnaces, paper balers, corn broom scrapers, etc.

* * *

Herzog Iron Works, Cypress and N. P. tracks, St. Paul, has been awarded contract totaling $150,000 for materials for the new federal court house at Fort Worth, Texas, the custom house, Philadelphia, and the county court house, Kansas City, Mo.

* * *

Newbury Bros. Pipe Fitting Co., Talladega, Ala., will start work immediately on a machine shop addition to its foundry. Announcement has not been made regarding the date when the foundry will be placed in operation.

* * *

Schill Mfg. Co., Crestline, O., whose foundry was destroyed by fire several years ago, has re-equipped a new foundry which was placed in opera-

RAW MATERIAL PRICES
Sept. 6, 1933

Iron	
No. 2 foundry, Valley[1]	$17.50
No. 2 Southern, Birmingham	13.50
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.50
Basic, Buffalo	16.50
Basic, Valley	17.00
Malleable, Chicago	17.50
Malleable, Buffalo	18.00
Coke	
Connellsville beehive coke premium	$4.50
Wise county beehive coke	3.00 to 4.25
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$13.00 to 13.50
Heavy melting steel, Pitts	13.00 to 13.50
Heavy metling steel, Chicago	9.50 to 10.00
Stove plate, Buffalo	9.00 to 9.50
Stove plate, Chicago	7.50 to 8.00
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	10.50 to 11.00
No. 1 cast, Pittsburgh	10.25 to 10.75
No. 1 cast, Philadelphia	12.00 to 13.00
No. 1 cast, Birmingham	10.00 to 10.50
Car wheels, iron, Pittsburgh	12.25 to 12.75
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	11.00 to 11.50
Malleable, Buffalo	11.00 to 12.00
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.75
Straits tin	45.25
Aluminum, No. 12, producers	19.00 to 22.00
Aluminum, No. 12 remelt Cleveland	12.75 to 13.75
Lead, New York	4.50
Antimony, New York	6.87½
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.65

tion recently in the production of gray iron castings. F. P. Hayes is president, E. B. Beall, vice president and treasurer, and E. T. Remy, secretary and general manager.

* * *

Summit Stoves Inc., Geneva, N. Y., recently was incorporated with $200,000 capital, has taken over the plant of the former Summit Foundry Co., in receivership. Earl C. Staley and Willard S. Kidney are interested in the company. Sufficient business is said to be on books to assure operations for the remainder of the year.

* * *

Bay City, Mich., plant of the Ohio Steel Foundry Co., Lima, O., adjacent to and formerly owned by the Industrial Brownhoist Corp., has been deeded back to the latter concern. Original transfer of the property to the Ohio Steel Foundry was made in 1930, but subsequent decline in foundry trade caused the withdrawal of the company from the Bay City territory.

* * *

Adams Foundry Corp., 1635 Brandywine street, Philadelphia, has bought all assets, including the name and all patterns, of the Adams Foundry Co. and will continue the business at the same address. Robert E. Moore is president; Thomas MacDonald vice president; B. W. Fredrick, secretary, treasurer; and E. S. Dailey assistant treasurer, assistant secretary and manager.

* * *

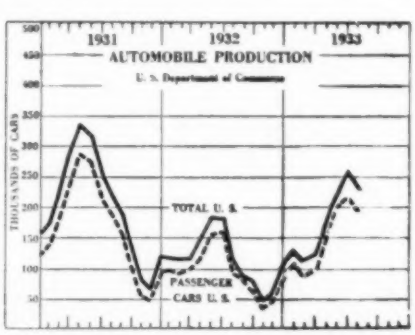
Independent Stove Co., Owosso, Mich., is operating under new management, but with no change in capital structure or control. M. H. Pryor, general manager and B. A. Nagelwort secretary-treasurer, both formerly were of Detroit. W. G. Mixer, foundry superintendent formerly was assistant foundry superintendent, Buick Motor Co., Flint, Mich. C. J. Sperry continues as general superintendent.

* * *

United States Pipe & Foundry Co., East Burlington, N. J., has started remodeling part of its plant at Bessemer, Ala., at a cost of about $250,000. The changes are undertaken to enlarge its capacity for production of deLavaud centrifugal cast iron pipe. Five complete deLavaud pipe machines will be installed, four to produce pipe from 3 to 12 inches, inclusive, and the fifth to produce 14 to 24-inch pipe, inclusive. All diameters will be in 18-foot lengths. A large annealing furnace and three new cupolas will be added.

* * *

General Bronze Corp., Long Island City, N. Y., has been awarded a contract for 600,000 pounds of ornamental bronze and 1,000,000 pounds of iron for decorative purposes in the construction of the United States federal court house to be erected in New York. The contract calls for about 1200 bronze double hung windows, 60 bronze casement windows, bronze entrances and vestibules including revolving doorways and sliding doors, bronze flagpole with ornamental eagle, directory boards, etc. Under the iron portion are included all the stairs in the building which are entirely cast, and other large items such as ornamental fence, gates, and guard grilles.



New Trade Publications

BRUSHES—Osborn Mfg. Co., 5401 Hamilton avenue, Cleveland, has issued a new 32-page industrial brush catalog containing information on the complete line of industrial brushes made by that company. Among the features of the new catalog are two charts which are designed to help the buyer or user to select the correct paint and varnish brush, or the correct wire wheel brush. Two pages of helpful information on wire brushes are included. All other types of brushes in the catalog are classified according to the particular types of work they are designed to accomplish, to simplify the selection.

ASH HANDLING EQUIPMENT—Hydro-Ash Corp., 115 South Dearborn street, Chicago, has published a booklet discussing the use of its equipment in the removal of ash from furnace pits.

TRANSMISSION BELT—An 8-page supplement to its mechanical goods catalog, discussing the function and varied operating conditions of transmission belting, some of the complexities involved in making rubber belts, etc., recently has been issued by the B. F. Goodrich Co., Akron, O.

ELECTRIC HEATING—General Electric Co., Schenectady, N. Y., has published a catalog on electric heating units and devices. Information is presented on immersion heaters, cartridge units, strip heaters, helical sheath-wire heating units, cast-in hotplates, metal melting pots, gluepots, soldering irons, industrial air heaters and control equipment.

CONVEYOR BELT—B. F. Goodrich Rubber Co., Akron, O., has issued a 4-page insert to its mechanical goods catalog covering general service conveyor belts and a hot material belt. The latter, it is claimed, increases the reasonable expectation of service for conveyor belts exposed to temperatures running up to 200 degrees Fahr.

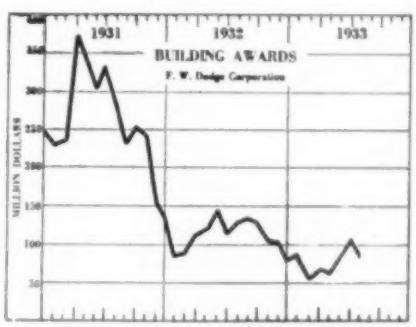
FOUNDRY EQUIPMENT—Recent publications of the Universal System of Machine Moulding and Machinery Co. Ltd., 13 Wilson street, London, E. C. 2., provide information on roller conveyors, sand preparation and sand reconditioning equipment, molding machines, cupolas, cupolettes, spark arrestors, chimneys, ladles, and plant accessories. The catalog on molding machines is particularly well illustrated with reproductions of photographs.

GRINDING WHEELS—The Norton Co., Worcester, Mass., has issued a catalog entitled "Grinding Wheel Specifications for Grinding Machines." The publication presents information on standard types of grinding wheels, special shapes of grinding wheels and standard shapes of grinding wheel faces. Considerable space is devoted to the listing of sizes and types of wheels for the various machines available for all kinds of grinding.

EMPLOYER-EMPLOYE RELATIONS—The problem of what to do about the employe who has grown old in a manufacturing organization and whose ability to do his work has lessened with the passing years is discussed in a new report of the Policyholders Service bureau, Metropolitan Life Insurance Co., 1 Madison avenue, New York, entitled "The Older Employe in Industry." The report is based upon data secured from 5000 manufacturing companies.

DAM CONSTRUCTION—Volume three in a series of booklets "The Story of the Hoover (Boulder) Dam" recently has been published by Ingersoll-Rand Co., 11 Broadway, New York. This volume describes the railroad system, gravel cleaning and concrete mixing plants and the lining of diversion tunnels with concrete. It also contains a general account of the Colorado river aqueduct which will transport water from the Colorado river to Los Angeles.

BAKELITE—The many services to which bakelite resinoid may be applied are discussed in a booklet recently issued by the Bakelite Corp., 247 Park avenue, New York. The material may be converted into six general classifications as follows: transparent materials; molding materials; laminated sheets, tubes and rods; liquid products—varnish, lacquer, enamel, cement—baking type; synthetic resins for quick-drying finishes; special resinoids.



Classified Ads

Help Wanted

WANTED

Experienced foundry man on medium and small production castings to take charge of modern foundry unit. Foundry located near Cincinnati. Applicants send credentials, past experience, etc., to Box 764, THE FOUNDRY, Cleveland.

Employment Service

SALARIED POSITIONS.
$2,500 to $25,000

This thoroughly organized advertising service of 23 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If you have actually earned over $2,500, send only name and address for details.

R. W. BIXBY, INC.
101 Delward Bldg., Buffalo, N. Y.

ATTENTION FOUNDRY OWNERS

Write or wire us for technically-trained practical foundry foremen, superintendent, production managers, chemists, metallurgists, core foremen, cost clerks, salesmen, patternmakers, melters (electric, open-hearth, converter and cupola.) No charge. Licensed Agency, McLAIN'S SYSTEM, INC., 804 Goldsmith Bldg., Milwaukee, Wis.

Positions Wanted

FOUNDRY METALLURGIST

Experienced in gray iron, steel and alloys desires connection. Accurate analyst and competent engineer. Any locality and immediately available. Salary open. Address Box 612, THE FOUNDRY, Cleveland.

RESULTS!

Coremaking, molding, cupola practice, patternmaking, expert rigger for production. 15 years experience handling men. Desire position as foreman or superintendent in gray iron foundry. Age 42. Reply at once. Address Box 678, THE FOUNDRY, Cleveland.

ELECTRIC FURNACE METALLURGIST

16 years active experience, acid or basic, carbon, alloys and irons. Specialist on castings. Want a living wage only with future. Perfect references. Address Box 747, THE FOUNDRY, Cleveland.

STEEL FOUNDRYMAN

Practical man. Twenty-five years general superintendent and plant manager. Successful in previous positions. Have records to show. Address Box 736, THE FOUNDRY, Cleveland.

GRAY IRON SUPT. OR MANAGER

Thoroughly experienced in all branches of foundry practice. Twenty-five years experience in responsible executive positions. Excellent references. Address Box 684, THE FOUNDRY, Cleveland.

NONFERROUS FOREMAN

Thorough experience on all nonferrous metals. Light or heavy castings. Take full charge mixing, melting, coremaking and molding. Age 50. Good health. Thoroughly reliable. Available now. Address Box 708, THE FOUNDRY, Cleveland.

FOUNDRY FOREMAN

of wide experience in jobbing and production, also metallurgy, open for position immediately. Located in Cleveland district. Address Box 776, THE FOUNDRY, Cleveland.

Positions Wanted

QUALITY IN YOUR MALLEABLE IRON

You want it. I produce it. My experience and special knowledge will save money for you. Large responsibility solicited. Metallurgy and supervision. Grafton M. Thrasher, 752 Robinson St., Elmira, N. Y.

GRAY IRON FOREMAN

or superintendent on work from 1 lb. to 50 tons. Specialized heavy machine castings. Mix by analysis. Many years experience as molder foreman and superintendent. Address Box 567, THE FOUNDRY, Cleveland.

PRACTICAL 32 YEARS MOLDER AND SUperintendent. Complete responsibility. Good record in sales, handling men, equipment, cupola, production or jobbing. Address Box 676, THE FOUNDRY, Cleveland.

FOUNDRYMAN

Age 39. 21 years experience. Desires connection. Started at bottom as molder. Has been inspector, foreman, superintendent, both jobbing and production shops in steel and iron. Address Box 741, THE FOUNDRY, Cleveland.

CHEMIST-METALLURGIST

Cupola expert. Knowledge electric furnace. Widely experienced on gray iron, semi-steel, nickel chrome. Automobile, Pipe and jobbing work. Sand control, molding. Address Box 657, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR GENERAL FOREMAN

of nonferrous foundry. Thoroughly practical in all branches, melting, molding, coremaking, jobbing and production work. Castings light and heavy, especially pressure and marine castings. Valves, plumbing goods, etc. Good executive. Highest references furnished. Address Box 739, THE FOUNDRY, Cleveland.

NONFERROUS SUPERINTENDENT-FOREman. Thoroughly experienced on production and jobbing. Good mixer and melter. Reliable. Best references. Go anywhere. Address Box 763, THE FOUNDRY, Cleveland.

SUPERINTENDENT—METALLURGIST

Practical foundryman, M. I. T. Graduate. Guarantee production of quality castings to rigid specifications at low cost. Fifteen years' experience, cupola and electric, plain, alloy, high-test cast iron, and nonferrous castings. Address Box 683, THE FOUNDRY, Cleveland.

PRACTICAL GRAY IRON MAN

Technically trained, age 30. 10 years experience jobbing and production shops as foreman and assistant superintendent, desires position with future. East preferred. Address Box 339, THE FOUNDRY, Cleveland.

SUPERINTENDENT OR FOREMAN

Twelve years experience, seeking connection with a steel foundry in need of a first class foundryman. Heavy or light, production or jobbing work. Practical molder. Technical graduate. Age. 43. Salary open. Go anywhere. A1 references. Address Box 749, THE FOUNDRY, Cleveland.

EXECUTIVE, AGE 42, EXPERIENCED ON PRODUCTION AND PRODUCTION WORK, DESIRES CHANGE, MIX GRAY IRON AND SEMI-STEEL BY ANALYSIS, McLAIN GRADUATE, EASTERN STATES PREFERRED. ADDRESS BOX 775, THE FOUNDRY, CLEVELAND.

Positions Wanted

PRACTICAL FOUNDRYMAN

on light jobbing and production work looking for position as foreman or would consider half interest in small gray iron foundry with man capable of bringing in work. East preferred. Address Box 753, THE FOUNDRY, Cleveland.

GRAY IRON AND SEMI-STEEL SUPERINTENDENT OR FOREMAN OPEN FOR ENGAGEMENT. BROAD EXPERIENCE. SMALL AND MEDIUM HEAVY CASTINGS. CAPABLE IN RIGGING AND PATTERN EQUIPMENT FOR MAXIMUM PRODUCTION. AGGRESSIVE LEADERSHIP. MIX BY ANALYSIS. ADDRESS BOX 452, THE FOUNDRY, CLEVELAND.

MANAGER OR SUPERINTENDENT

Malleable or gray iron. Twenty-five years experience. Past ten years general manager large corporation, malleable division. Can handle entire operations, sales, and factory. Well acquainted with automobile trade. Age forty-five. Very highest references. Address Box 744 THE FOUNDRY, Cleveland.

ELECTRIC MELTER

High test gray iron, malleable and steel, acid or basic. Metallurgical training. Capable of full responsibility of metal. Economy and quality. Employed throughout depression. Address Box 757, THE FOUNDRY, Cleveland.

BRASS FOUNDRY FOREMAN

with 23 years practical experience on heavy and light castings. Good rigger and melter. Sober, hard worker. Go anywhere. Address Box 760, THE FOUNDRY, Cleveland.

FOUNDRY MANAGER — SUPERINTENDENT

Twenty years proven executive ability. Gray iron, semi-steel and alloy iron. Light, heavy, green and dry sand. Pressure castings, tire molds, engine, machinery and jobbing work. Practical metallurgist. Sales experience. Mix by analysis. A No. 1 Cupola Practice. Best reference. Address Box 773, THE FOUNDRY, Cleveland.

BRASS FOUNDRY FOREMAN WANTS POSItion. 20 years experience in brass, bronze and aluminum. Address Box 771, THE FOUNDRY, Cleveland.

FOUNDRY ENGINEER OR PATTERN SUPERintendent. Twenty years experience—twelve executive. Layout, design, development and rigging for production. Graduate mechanical engineer. Creative. Practical. Last seven years with large mid-west foundry specializing in automotive castings Address Box 767, THE FOUNDRY, Cleveland.

COREMAKER

Twenty years experience with all phases of coreroom practice, bench and floor. Good knowledge of molding light to heavy castings. Age 38. Married. Address Box 772, THE FOUNDRY, Cleveland.

GRAY IRON FOREMAN

On light medium jobbing stove furnace production. Know pattern rigging for machines from squeezer to sandslinger. Save money on cupola, cleaning, coreroom cost. Reference. Address Box 768, THE FOUNDRY, Cleveland.

CORE ROOM FOREMAN

Experienced on general jobbing and production gray iron, malleable or steel. Will locate anywhere with good church and school facilities. Address Box 770, THE FOUNDRY, Cleveland.